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FUNCTIONAL AND DYSFUNCTIONAL BUREAUCRACY AND THEIR IMPACT ON ECONOMIC DEVELOPMENT AND QUALITY OF LIFE

by
OLEG ZINAM *

Abstract

Growing complexity, interdependence and dynamism of modern life have contributed to an unprecedented global rise in number, size and power of bureaucratic organizations. Depending on the circumstances they can continue to be effective or can decay and degenerate to a point of becoming utterly dysfunctional. This article deals with (1) direct and indirect impacts of bureaucratic structures on economic wellbeing and overall quality of life; (2) factors leading to bureaucratic entropy; (3) distinction between technical efficiency and total effectiveness; (4) relationship between quality of life and quality of man; and (5) concept of optimal quality of life.

1. *Impact of Bureaucracy on the Quality of Life*

Limited natural and human resources in any society must be used to satisfy human wants. This process leads to attainment of material wellbeing one of the most fundamental component parts of the over-all quality of life. Whether technology will be fully utilized for this purpose and whether individuals' quality of life will be assigned high priority depends on value-systems (ideologies) and preferences of those in control of power. Moreover, between these value-systems and preferences on one hand and society's resources and technology, on the other, stands its organizational and

* University of Cincinnati, Dept. of Economics, Cincinnati, Ohio (U.S.A.).

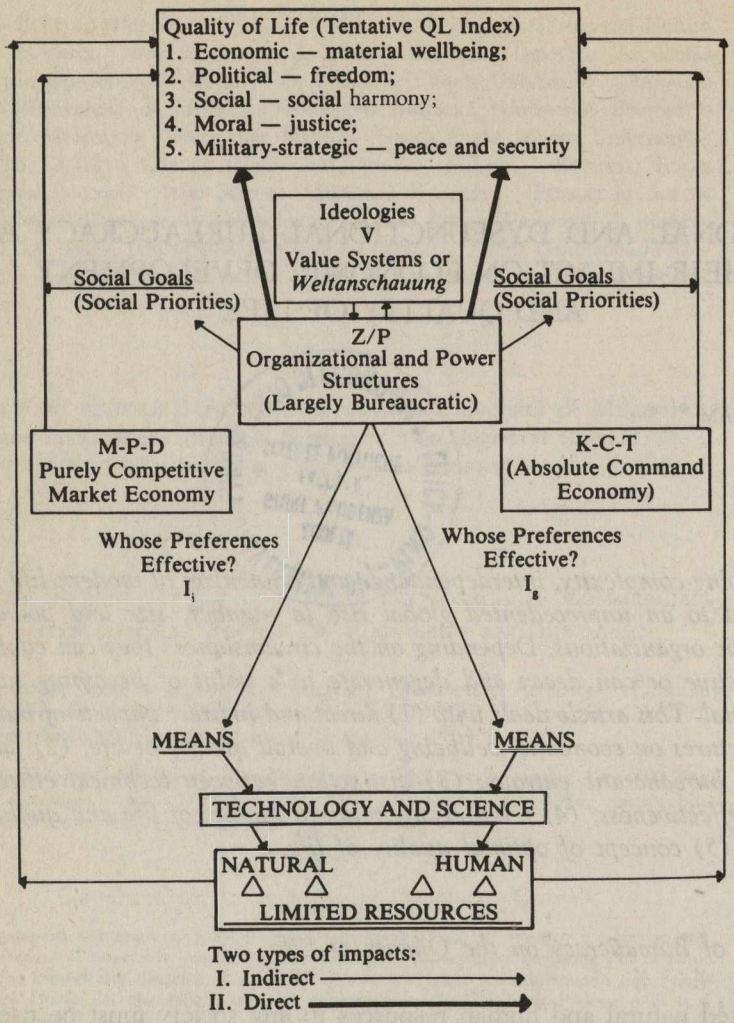

FIGURE 1. Impact of Organizational and Power Structures on the Use of Technology and the Quality of Life

power structure, which affects peoples' quality of life in a *direct* and *indirect* manner.

The *indirect* impact of organizational and power structures is achieved through the determination of who has ultimate power to set the socioeconomic priorities of a nation. For example, in a centrally controlled command economy, people's quality of life might be placed at the bottom of leader-

ship's preference scale, while in a predominantly market economy of a libertarian type, quality of life might be set as the top priority by government in accordance with the preferences of its constituents. Organizational and power structure also exerts *direct* influence on such important component parts of quality of life as economic and political freedom, social justice, human rights and human dignity. Both effects must be assessed before a judgement of the total impact of bureaucratic organization on quality of life is made.

This article is focused primarily on the properties and characteristics of modern organizational structures and their impact on socioeconomic systems and their development. Together with ideology and technology, organization shapes nations and greatly affects their destiny. In the last century or so, organizations have grown in size, complexity, power and importance. It would not be an exaggeration to state that we live in a world of expanding bureaucracy – a formal and impersonal type of organization – which tends to dominate our daily lives. It is important to stress that bureaucracy per se is an ethically neutral term. Its effect on society depends on its efficiency, on the purpose it serves and on the quality of human beings who run it.

2. *Bureaucracy on the March*

Bureaucracy can be defined as "a formal organization characterized by the rational operation of a hierarchical authority structure and explicit procedural rules" [1]. It is the most efficient way to organize efforts of a large number of people for the attainment of objectives which differ from the goals of its individual members. A bureaucratic organization provides a system of incentives, rewards and sanctions to induce its members to work for organizational objectives. It would not be an exaggeration to state that it is among the greatest inventions of all times with about the same significance as the discovery of fire, wheel, money and phonetical alphabet. A vigorous affirmation of its usefulness would not be needed if the term were not used in a derogatory sense. Effective and honest bureaucratic organizations do exist and whether they behave functionally or dysfunctionally depends on the quality of the people who comprise them, especially their leaders.

Change in scale and character of the socioeconomic organizations in market economies was caused primarily by the advance of modern technology. In Kuznets' words:

[1] *Encyclopedia of Sociology* (1974, p. 30).

The scale of the plant and the size and life of capital investment required by the technology of modern economic growth... forced a shift from personal ownership-management units to the large scale corporations. And when inevitable monopolistic tendencies of the latter... required regulation by the government, regulation in turn contributed to fixing the nonpersonal organization in these industries and... widened the economic role of a government, itself a nonpersonal organizational unit [2].

The emergence of the Soviet Union after WWI and of a dozen or so other command economies after WWII, all of them highly centralized public bureaucracies, reinforced the general global trend toward further depersonalization of organizational structures. In command economies on the level of the firm, the large size of industrial firms was caused by the "gigantomania" of the leaders and a need for reducing the cost of central administration by an increase in the size of the units and decrease in their number.

Max Weber was convinced that "the dynamism of the capitalist process inevitably resulted in a steady growth of more and more gigantic bureaucratic structures" [3]. Though he believed that bureaucratic organization is one of the essential characteristics of modern capitalism, he did not think that it is its exclusive property. Bureaucracy is present in any society which is so organized that its goals constitute impersonal ends to its members. In his view, all socialist policies were "bound to foster bureaucratization and ossification of society" [4]. According to him, bureaucratic organization is characterized by a hierarchical authority structure, clearcut division of labor, a formal system of rules and regulations, impersonality toward clients, a specialized administrative staff, and a promotion system based on seniority or merit.

Even under the assumption that a bureaucratic organization is manned by a group of honest, responsible and dedicated officials, the danger of formalism, ossification and rigidity in decision making is very acute. Weber was aware of this and was worried by the emergence of ever-more efficient and powerful bureaucracies in capitalist economies. He feared that this process might lead to a "new iron cage of serfdom", in which "all forms of value-oriented social conduct could be suffocated by the almighty bureaucratic structure" [5].

Weber disagreed with Marx's contention that the misery and poverty of the masses are caused by private ownership of factors of production and

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[2] KUZNETS (1965, p. 101).
[3] MOMMSEN (1974, p. 107).
[4] *Ibid.*, p. 67.
[5] *Ibid.*, p. 67.

by private exploitation of workers by capitalists. In his view, socialism, after expropriation of capitalists, would retain expropriation of workers and make all of them utterly dependent on the government, itself a huge bureaucratic organization. Nationalization of all capital would merely speed up the process of bureaucratization. The iron cage of modern industrial labor would not be destroyed, but merely reinforced by a further boost toward bureaucratization [6].

Marx saw the demise of capitalism in a process of concentration of economic power in fewer and fewer hands of capitalists surviving after the devastation caused by overproduction and the declining rate of profit. For him, the solution was to expropriate these few remaining capitalists and transfer the ownership of capital to the public – presumably the government. After that, the dictatorship of the proletariat would cleanse society from the remnants of capitalism and establish a classless society. A by-product of this process would be elimination of poverty caused by capitalist exploitation. At no time did Marx contemplate the possibility of the emergence of a powerful state capable of a much greater degree of exploitation than private capitalists. His implicit assumption of governmental agencies selflessly serving society was naive to say the least.

Weber understood that nationalization of all means of production will not solve the problem of social injustice, but in all probability aggravate it. History was on Weber's side when he pointed out that "the real cause of alienation, not only of working classes but of the great majority of the population in modern societies, lay in the emerging bureaucratic structures and not so much in the particular modes of the distribution of wealth" [7].

Weber's views on the future of capitalism were tinted by the fear that bureaucracy will tend to reorganize everything according to an "instrumentally-rational" principle which, carried to the extreme, would endanger all forms of individual creative social activities and lead to the ossification of social structures [8]. In his analysis, Weber stressed the functional aspect of bureaucracy as an "ideal type" and did not dwell on the anomalies of bureaucratic order which must be taken into account to gain a more realistic picture of its impact on technology and quality of life.

In a highly organized society, larger impersonal organizations represent a major source of power. Ideally, this power has to be used to attain the objectives for which the organization was created. One of the major tasks of a bureaucracy is to survive and to continue to perform its functions. To do

[6] *Ibid.*, p. 58.
[7] *Ibid.*, p. 71.
[8] *Ibid.*, p. 102.

so, "it must act in such a way as to promote the power to act" and to enhance its power in the future. An organization operates "as if it were animated by the power principle, even though this is a reflection of the behavior of its leading members". Management must be sure that choices made in the present will broaden its freedom of choice in the future [9]. If organizational behavior switches to the maximization of its power for its own sake, then the original goals of organization might be neglected or even abandoned and bureaucratic self-aggrandizement will become the order of the day with all its negative implications for society. This phenomenon falls into the sociological category of "displacement of goals" or "ethicizing of means".

3. *Borgs versus Dysborgs*

It is only natural that an organization guided by the power principle would strive to protect its decision-making processes from the uninformed intrusion of outsiders in order to minimize external interference with its decisions. Thus the internal dynamics of bureaucracy tends to create a closed organization in the service of bureaucrats. As the firm grows, the number of stockholders increases and stockholdings tend to disperse. Stockholders accept the weakness of their position and tend to become passive, while the directors realize that their power is now derived from management and not from the stockholders [10].

Large bureaucratic organizations are ruled by impersonal, rationally established rules and this is essential in coordinating efforts of large numbers of office holders toward the attainment of organizational goals. This type of coordination and control provides a certain degree of protection from the whims and arbitrary decisions of the supervisors, yet, impersonality carried to extreme leads to formalism, depersonalization and even alienation [11].

Bureaucratic organization, in its original and broadest meaning, is a means to direct, control and evaluate the efforts of a large number of human beings with their divergent personal goals, dreams and aspirations toward the attainment of organizational goals. Bureaucracy defines the rights and responsibilities of its members and achieves their compliance by establishing a system of rewards and sanctions to keep their actions in harmony with

[9] ALDERSON (1957, p. 51).

[10] GALBRAITH (1973, pp. 85, 98).

[11] COSER and ROSENBERG (1957, p. 134).

organizational policies formulated by its leaders. Our indebtedness to Weber for his deep insight into the nature of bureaucratic organization cannot be overemphasized.

Though Weber saw bureaucratic organization as an outstanding feature of modern capitalism, he understood that it is not its special feature. It exists in any society which is organized in such a manner that its goals constitute impersonal ends to participants. Bureaucratic organizations exhibit "an inborn, insatiable appetite for more and more formal rationalization" and "recognize everything it comes into contact with according to strictly 'instrumentally-rational' principles". Thus, bureaucracy, based on this principle, is an inextricable characteristic of modern capitalism which is viewed by Weber as "the most efficient form of social organization ever attained in the history of mankind" [12].

In this paper the term Borg depicts a functional bureaucratic organization, while Dysborg is designated as its opposite – a dysfunctional bureaucratic structure. There is not much room in this article to cover all the good qualities of Borgs and all shortcomings of Dysborgs. Yet, it is useful to mention some of them. Among the good characteristics of Borgs are: Power to attain objectives, impersonality, routinization of lower functions, liberation of upper management from administrative details, relative autonomy (freedom from external controls), limited responsibility, stability and potential permanence ("immortality"), rationality, facilitating specialization and division of labor, and the channeling of information flows, to name only a few. A typical Dysborg exhibits the opposite qualities: Pursuit of power for its own sake, clique formation, ritualism, flight from responsibility, ossification, risk aversion, preservation of *status quo,* rationalization, trained incapacity, gigantomania, red tape and many other shortcomings.

4. *Technical Efficiency and Total Effectiveness*

All human institutions, including ideology, organization and technology, can be used functionally, in the sense of serving the purposes they are supposed to serve to promote socioeconomic development, or dysfunctionally – in a manner hampering this development. From the point of view of purely technical efficiency as well as overall effectiveness, all bureaucracies can be placed on a scale (spectrum) between two poles representing "pure types" designated as Borgs (functional bureaucratic organizations) and Dys-

[12] MOMMSEN (1974, p. 64).

borgs (dysfunctional bureaucratic organizations). The degree of purely technical efficiency will determine the relative position of a given bureaucracy on this scale. If one includes an evaluation of the organizational goals themselves, the classification becomes more complex. The addition of another (vertical) scale superimposed on the efficiency scale (horizontal), representing an ethical evaluation of organizational objectives, results in a four-fold classification of organizational effectiveness or bureaucracies (see Figure 2).

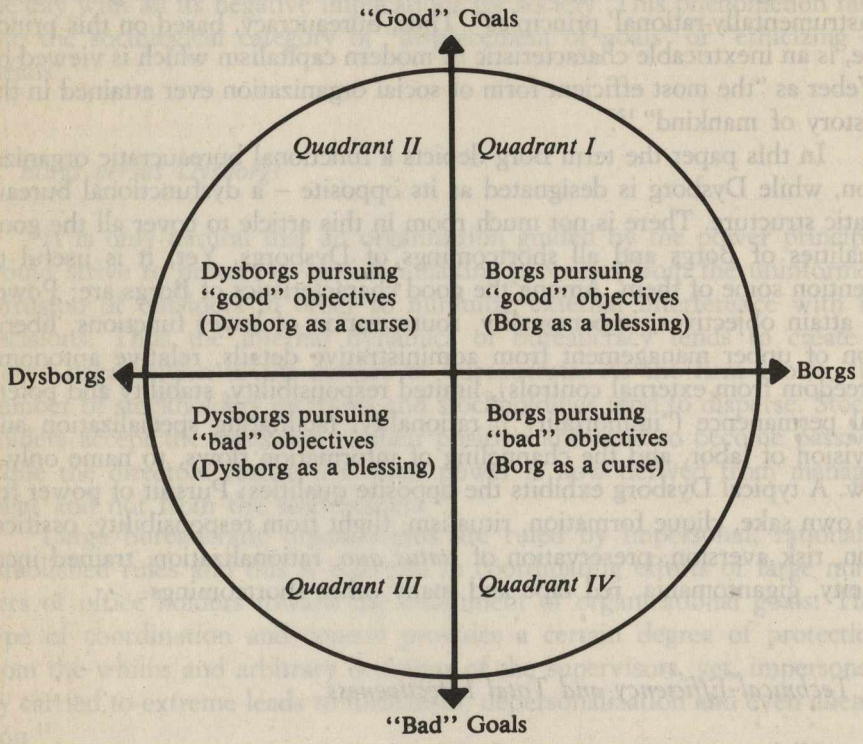

FIGURE 2. Technical Efficiency versus Overall Effectiveness of Borgs and Dysborgs

The Borg-Dysborg relationship is depicted by a horizontal axis, while the ethically desirable versus ethically undesirable objectives pursued by bureaucracies are placed on a vertical axis. The intersection of these two axes leads to the following four-fold classification: Quadrant I – Borg pursuing desirable goals; Quadrant II – desirable goals pursued inefficiently by a Dysborg; Quadrant III – undesirable goals advanced in an inefficient manner by a Dysborg; and Quadrant IV – Borg pursuing undesirable goals. On

a scale of overall effectiveness these quadrants are lined up in order of their social desirability. It must be pointed out that, depending on the desirability of objectives pursued, Borgs and Dysborgs can either enhance or hamper the process of development.

Some examples might illustrate the usefulness of this classification. In quadrant III one could place the Soviet government pursuing goals detrimental to the quality of life of the Soviet people with considerable inefficiency – a case of Dysborg in pursuit of "bad" goals. This could be viewed as a blessing, while an extremely "efficient" Borg in charge of extermination of those who oppose a totalitarian regime (Quadrant IV) is an abomination. Thus not all Borgs are good and Dysborgs bad. In a libertarian market-oriented economy, well-run Borgs are a definite blessing (Quadrant I), while negative aspects of private and public Dysborgs, most dramatically evident in some LDCs, can hamper economic development and turn a potential economic advance into an economic crisis, stagnation and misery (Quadrant II) [13].

5. *Entropy, Displacement of Goals and Power Principle*

Since total effectiveness and purely technical efficiency of bureaucracies have a crucial impact on quality of life, and since they have the potential for both improvement and deterioration, it is useful to throw some light on a few causal factors leading to these changes. A theory of social change based on necessary and sufficient conditions – a coincidence of power and will – and a theory of discontent suggest that technical efficiency of a bureaucracy and its total effectiveness depend to a great extent on the quality of the management (people) running it. But assuming that the quality of managers is constant, are there any factors which will eventually lead to its deterioration? If nothing is done about it, does a Borg tend to degenerate into a Dysborg?

If a bureaucracy is run by "angels" motivated by the most altruistic intentions and possessing perfect knowledge and ability to foresee all implications of their decisions and actions, the Borgs will tend to remain Borgs. If intentions are perfectly selfless but perfect insight is lacking, the outcomes might be contrary to intentions – a social phenomenon named by Merton "latent function" in contrast to "manifest function" signifying the results in accordance to intentions of a decision-maker [14].

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[13] MIECZKOWSKI and ZINAM (1984).

[14] *Encyclopedia of Sociology* (1974, pp. 154, 164).

However, if it is assumed that humans are not angels but have a potential for both good and mischief, the outcome is uncertain. Yet, if no conscious efforts are made to improve the system or to prevent its deterioration, some impersonal social forces will tend to lead toward the transformation of Borgs into Dysborgs.

According to the "power principle" already mentioned in previous analysis, the bureaucrats tend to act in such a way as to enhance their power and to broaden their future range of choices. This principle eventually leads to expanding their power for the sake of power [15]. Power, instead of being used with the legitimate purpose of attaining the objectives of organization as a whole, tends to become an instrument of self-aggrandizement of the bureaucratic elite. The latter can use this power as a means to achieve their own personal objectives.

The power principle is an outstanding example of a social phenomenon called "displacement of the goals" or "ethicizing means". Human beings in general, and the bureaucrats in particular, have a general tendency to downgrade and with time even forget the original objectives or goals for the attainment of which their bureaucratic organization was established. Thus the means are transformed into an ultimate end to be attained for its own sake: Ritual replaces a genuine article of faith; adherence to form replaces substance; blind application of an accepted bureaucratic procedure replaces a genuine search for enlightened and effective ways of solving organizational problems; depersonalization of relationship crowds out their creative efforts to apply the rules to serve the needs of clients or employees; blind and selfish effort to enhance and expand the power of individual departments and bureaus leads to the reduction of overall effectiveness of the bureaucratic organization as a whole (fallacy of composition) and so on. All these and many other anomalies of bureaucratic organizations will tend to develop, unless the conscious efforts of high quality people controlling the bureaus are directed toward preventing and eliminating their appearance and proliferation.

Organizational anomalies caused by the principle of displacement of goals can be considered one of the manifestations of a process called social entropy. On the physical level, entropic processes are the transformation of "free" energy, primarily produced in nature by photosynthesis, into "bound" energy. When a piece of coal burns out, it releases free energy leaving "bound" energy in the ashes. Social entropy is a process analogous to this natural phenomenon. Potentially "free" energy at the disposal of a bureau-

[15] ALDERSON (1957, p. 51).

cratic organization is spent on purposes serving the bureaucrats themselves rather than on the advancement of organizational goals and is thereby converted into "bound" energy. The "free" energy which should have been released to initiate and sustain socioeconomic change and technological advance is lost to society as a whole and transformed into benefits to the bureaucrats themselves.

Weber was fully aware of the dysfuntional tendencies in bureaucratic organizations and the rise of "even more gigantic and powerful bureaucracies on all levels of social life". He believed that this process would eventually bring about a thoroughly 'goal-oriented' type of society in which a purely instrumental relationship would dominate social conduct everywhere. He feared that "rationalization and intellectualization – being the two most effective forces in world history – would no longer permit individual creativity and personal values to play any significant role in social relations". In his view, "the bureaucratization of society will... some day triumph over capitalism, in our civilization just as in ancient civilizations" [16].

In contrast to Marx, he thought that "the real cause of the 'alienation', not only of the working classes, but of the great majority of the population in modern societies, lay in the emerging bureaucratic structures and not so much in the particular modes of the distribution of wealth" [17]. Weber was deeply concerned with the threats to the rights of man, individual liberties, freedom of the press and preservation of the competitive economic order in capitalist societies. He was afraid that "some elements were being created which would eventually bring about a stagnant society of a bureaucratic nature" [18].

Though pessimistic in his general outlook, he saw some hope in the emergence of charismatic leaders whose followers "are willing to make the values of the charismatic leaders their own, to do everything in their power to reconstruct social reality in accordance with them". According to Weber, charisma, the power of ideas, represents a creative revolutionary force in history. It inspires "value-oriented individuals who, by grasping for something far beyond their reach for 'other-worldly' and not day-to-day reasons, bring such enormous energies to bear on social reality that the course of events is given a new direction,... that the social order is revolutionized" [19]. Charisma, then, serves as a revitalizing factor or as a negentropic force which offsets the entropy leading to stagnation. Yet, Weber did not attempt

[16] MOMMSEN (1974, p. 99).
[17] *Ibid.*, p. 71.
[18] *Ibid.*, p. 99.
[19] *Ibid.*, p. 102.

to analyze the moral content of the *Weltanschauung* of charismatic leaders who might revitalize bureaucracies and improve their technical efficiency while generating a type of revolutionary movement which could lead to the destruction of present cultural and moral values of society.

6. *Quality of Life and Hierarchy of Needs*

The concept of quality of life is extremely complex. In this section of the paper the attempt is made to identify and classify some important aspects of quality of life and to depict some crucial relationships among them. It is important to recognize that they are hierarchically structured. Abraham Maslow has done extensive work in constructing a scheme or hierarchy of human needs [20].

Economists, in general, attempt to limit their theorizing to human wants which are subjective and represent the difference between what human beings believe they should have and what they actually have. Utility is then defined as the ability to satisfy human wants and the conventional economic model of consumer behavior describes man as *homo oeconomicus* or economic man who strives to maximize the satisfaction of his wants. Subjective wants, treated by economists, have a strong basis in objective needs described and classified by Maslow. Yet, knowledge of objective needs implies understanding human nature, while human nature, in turn, cannot be defined without knowledge of the purpose of human existence and life in general. And since the study of human nature and purpose of life are in the realms of ethics and metaphysics, one can understand the reluctance of economists and other social scientists to get involved in these fields of knowledge.

Yet, Maslow's hierarchy of needs is an indispensable contribution to a broader and deeper understanding of quality of life. A graphic presentation of the component parts of quality of life and their relationship to some crucial aspects of the overall development is made in Figure 3. Six basic areas of development and corresponding parts of quality of life are presented: (1) the ecological – dealing with the safety of our natural environment; (2) the military – concerned with peace and security; (3) the economic – stressing human material wellbeing; (4) the social – based on social harmony and justice; (5) the political – dealing with freedom, human rights and dignity; and (6) the cultural – based on the preservation and fostering

[20] MASLOW (1970, pp. 35, 39, 43, 45, 46).

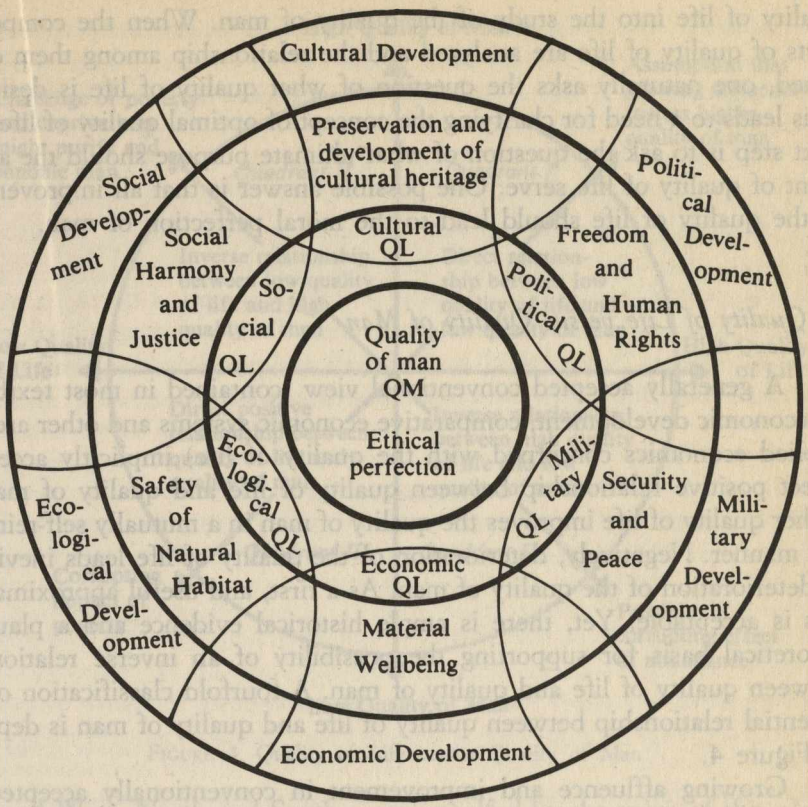

FIGURE 3. Component Parts of Quality of Life

of the development of cultural values. This list, of course, is neither complete nor exhaustive, but covers some areas of great importance.

Such classification is useful because it suggests extensive future studies of possible complementary and competitive relationships among the listed aspects of the component parts of quality of life. If the relationship between any two of them is one of substitution or competitiveness, one can develop a scheme of trade-offs; if the component parts are complementary, no trade-offs are possible. For example, freedom and material wellbeing (welfare) can, to a certain extent and under some circumstances, be considered competitive "goods" subject to substitution and trade-offs. Yet, if this substitution is carried too far, the relationship changes into one of complementarity without possibility of further trade-offs.

Figure 3 also suggests that in the area of moral development which should lead to ethical perfection, one moves from the component parts of

quality of life into the study of the quality of man. When the component parts of quality of life are analyzed and the relationship among them established, one naturally asks the question of what quality of life is desirable. This leads to a need for clarifying the concept of optimal quality of life. The next step is to ask the question of what ultimate purpose should the attainment of quality of life serve. One possible answer is that all improvements in the quality of life should lead to the moral perfection of man.

7. *Quality of Life versus Quality of Man*

A generally accepted conventional view (contained in most textbooks on economic development, comparative economic systems and other areas of applied economics concerned with the quality of life) implicitly accepts a direct positive relationship between quality of life and quality of man. A higher quality of life improves the quality of man in a mutually self-reinforcing manner. Negatively, deterioration of the quality of life leads inevitably to deterioration of the quality of man. As a first, and useful approximation, this is acceptable. Yet, there is ample historical evidence and a plausible theoretical basis for supporting the possibility of an inverse relationship between quality of life and quality of man. A fourfold classification of the potential relationship between quality of life and quality of man is depicted in Figure 4.

Growing affluence and improvement in conventionally accepted aspects of quality of life (mostly economic wellbeing) can contribute to decay in the moral values of a society. Some signs of moral "decadence" are plaguing highly developed industrialized societies of the West, while some oil-rich Arab countries, caught by the powerful impact of immense wealth created almost overnight by their exports of "black gold", feel their cherished cultural values, traditions, mores and customs imperiled and even threatened by destruction (Quadrant IV).

On the other hand, a low level of quality of life and the process of its decline, might, under specific circumstances, make man stronger and improve his moral qualities. Perhaps the "economic miracles" in Japan, West Germany and France after WWII might serve as some approximation to this type of reasoning. A possible relationship of this sort, depicted in Quadrant II, has also considerable support in numerous religious writings.

The concept of "revolution of rising expectations" is an excellent example of almost blind acceptance of the positive relationship between quality of life and quality of man depicted in Quadrant I. Presumably all people –

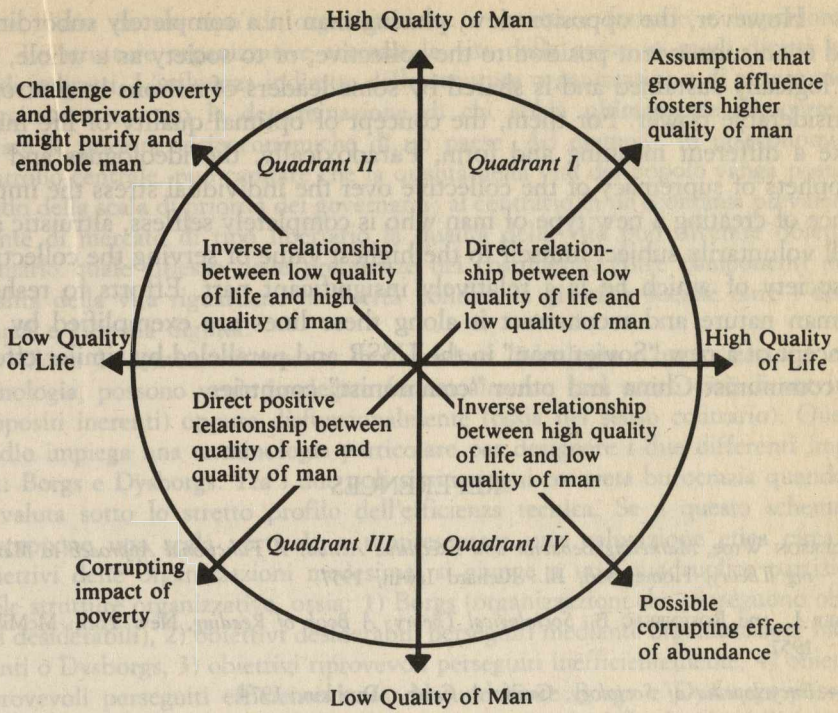

FIGURE 4. Quality of Life versus Quality of Man

East and West, North and South – are engulfed by the spirit of this global post-WWII revolution. Positively stated, it is a universal belief that all human beings have the basic right to expect the attainment of ever higher material wellbeing (welfare). In negative terms, the belief can be placed in Quadrant III. Poverty corrupts and destroys human dignity. Therefore, all human beings have the inherent natural right to some minimum level of economic welfare below which human dignity cannot possibly be sustained.

8. *The Concept of Optimal Quality of Life*

If the ultimate purpose of improving quality of life is moral perfection, perfection of man or the gradual ascendance of man toward an ideal state of *homo humanis* (a truly human being, who is humane), then optimal quality of life is one which will lead to the attainment of this purpose. This view is, of course, based on the Greco-Roman-Judeo-Christian tradition of our "Western" civilization and is shared by major religions of the world.

However, the opposite view, placing man in a completely subordinate and even subservient position to the collective, or to society as a whole, can be logically sustained and is shared by some leaders of nations in control of considerable power. For them, the concept of optimal quality of life might take a different meaning and form. Paradoxically, the ideologues and the prophets of supremacy of the collective over the individual stress the importance of creating a new type of man who is completely selfless, altruistic and will voluntarily subject himself to the highest value of serving the collective, a society of which he is a relatively insignificant part. Efforts to reshape human nature and reconstruct it along these lines are exemplified by the concept of a new "Soviet man" in the USSR and paralleled by similar efforts in communist China and other "communist" countries.

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BUROCRAZIA FUNZIONALE E DISFUNZIONALE E SUO EFFETTO SULLO SVILUPPO ECONOMICO E LA QUALITÀ DELLA VITA

Questo lavoro tratta delle proprietà e delle caratteristiche delle moderne strutture organizzative e dei loro effetti sui sistemi socioeconomici. Insieme alla ideologia e alla tecnologia, l'organizzazione dà forma alle nazioni e ne influenza i destini. La nostra vita quotidiana tende a esser dominata da burocrazie in espan-

sione, ossia da un tipo di organizzazione a carattere formale e impersonale.

Le strutture organizzative toccano la vita della gente in modi diretti e in modi indiretti. L'influenza indiretta delle strutture organizzative e di potere viene esercitata attraverso la determinazione di chi abbia ultimamente il potere di fissare le priorità socioeconomiche di un paese. Ad esempio, in un'economia a controllo centrale, può capitare che la qualità della vita del popolo venga posta al fondo della scala di priorità dei governanti; al contrario in un'economia prevalentemente di mercato di tipo libertario la qualità della vita può divenire obiettivo primario quale riflesso delle preferenze dei costituenti. Altre componenti della qualità della vita riguardano la libertà politica, la giustizia sociale oltre i diritti umani e l'umana dignità.

Tutte le istituzioni umane, includendovi l'ideologia, l'organizzazione e la tecnologia, possono venir impiegate funzionalmente (nel senso cioè di servire i propositi inerenti) oppure disfunzionalmente (ossia nel senso contrario). Questo studio impiega una terminologia particolare per designare i due differenti impieghi: Borgs e Dysborgs. Tra i due poli si situa ogni concreta burocrazia quando la si valuta sotto lo stretto profilo dell'efficienza tecnica. Se a questo schema si sovrappone una scala verticale a rappresentare una valutazione etica circa gli obiettivi delle organizzazioni medesime, si giunge a una quadruplice partizione delle strutture organizzative, ossia: 1) Borgs (organizzazioni che perseguono obiettivi desiderabili), 2) obiettivi desiderabili perseguiti mediante organizzazioni inefficienti o Dysborgs, 3) obiettivi riprovevoli perseguiti inefficientemente, 4) obiettivi riprovevoli perseguiti efficientemente. Naturalmente Borgs e Dysborgs possono ostacolare o favorire lo sviluppo dell'umanità a seconda della desiderabilità o non desiderabilità degli obiettivi. In certi casi la riprovabilità degli obiettivi imposti da un governo socialista o altrimenti illiberale può condurre a effetti negativi meno gravi per effetto della scarsa efficienza nel perseguire quegli obiettivi: esempi vengono qui portati. Si sottolinea inoltre che il concetto di qualità della vita è piuttosto complesso: l'aspetto economico ne è solo una parte, che riguarda il benessere materiale, mentre altri aspetti sono costituiti dallo stato delle difese militari, dalla giustizia sociale, la libertà politica e culturale.

Si studiano infine le multiformi relazioni che intercorrono tra qualità della vita e qualità dell'uomo.

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TEORIE ASSIOMATICHE E STRATEGICHE DELLA CONTRATTAZIONE: RISULTATI COMPARATI

di
PIERO TEDESCHI *

1. *Introduzione*

Il problema della contrattazione è uno dei più antichi della teoria economica e rimane ancora irrisolto. La prima formulazione rigorosa è dovuta a Edgeworth (1881), la cui soluzione contiene una molteplicità di equilibri, come può essere facilmente verificato in una esposizione da libro di testo della "scatola di Edgeworth".

Si sono imboccate due vie differenti per risolvere questo problema. Una iniziata da Nash (1950), il quale impose alcune restrizioni assiomatiche sul comportamento degli agenti, in base all'assunzione che gli agenti facciano domande nello spazio di utilità. Se le domande dei vari agenti sono compatibili, essi ottengono almeno quanto hanno chiesto, mentre se non sono compatibili gli agenti ricevono il livello di utilità corrispondente allo "status quo". Il risultato più importante è che se imponiamo sulla soluzione la condizione di Pareto-ottimalità, simmetria, indipendenza da alternative irrilevanti e da trasformazioni lineari allora vi è un unico equilibrio che è il massimo della funzione $\prod_{i=1}^{N} (x_i - d_i)$ sull'insieme delle allocazioni delle utilità possibili, dove N è il numero dei giocatori, x_i è l'utilità del giocatore i e d_i la sua utilità al livello di strategie di minaccia [1].

Anche se queste teorie hanno consentito alcuni progressi nella trattazione dei problemi della contrattazione, esse hanno alcuni limiti, il maggiore dei quali è che tutte le proprietà del gioco non possono essere giustificate

* Università Bocconi, Milano.

[1] Per le definizioni, tutte le proprietà citate, la dimostrazione dell'asserzione riportata nel testo e per altri risultati dell'approccio assiomatico rimandiamo a ROTH (1979).

solo in base alla razionalità individuale, né facendo appello a motivazioni intuitivamente ragionevoli. La insoddisfazione per questo tipo di approccio è stata implicitamente dimostrata per primo dallo stesso Nash (1953), quando tentò di giustificare il suo concetto di soluzione come il limite di una serie di equilibri di una corrispondente serie di giochi che definì "giochi smussati" ("smoothed games").

Nonostante questa seria limitazione non vi sono state trattazioni del problema della contrattazione che potessero portare a proprietà desiderate (come la Pareto-ottimalità) e allo stesso tempo fossero rigorose in termini di teoria dei giochi, almeno fino al lavoro di Rubinstein (1982). Il suo gioco sarà descritto in dettaglio più oltre, ma il problema è di dividere una torta di dimensioni unitarie tra due giocatori, i quali devono fare proposte e controproposte finché non raggiungono un accordo. I due agenti hanno utilità trasferibili e sopportano dei costi nel dilazionare l'accordo. Il risultato è che questo gioco possiede un equilibrio perfetto Nash e in alcuni casi particolari questo equilibrio è unico.

Ci sono stati vari tentativi di generalizzare questo modello, ad esempio Binmore (1982). Questo articolo dimostrerà che il gioco di Rubinstein può essere, in un certo senso, generalizzato e che un'ampia classe di giochi ha un unico equilibrio. Il risultato non è completamente nuovo, ma le dimostrazioni certamente lo sono. La dimostrazione del teorema centrale fa uso della teoria dei giochi a orizzonte infinito di Fudenberg-Levine (1983). Questa nuova dimostrazione è la più semplice fra quelle presenti nella letteratura, ed è costruttiva. Questo significa che siamo in grado di fornire un algoritmo per calcolare strategie di equilibrio perfetto con il grado di approssimazione desiderato. Questa proprietà è ovviamente molto utile per ogni teoria qualora s'intenda sottoporla al controllo empirico. Inoltre, essa consente di dimostrare facilmente se l'equilibrio perfetto così costruito ha proprietà simili a quelle assunte dalla teoria assiomatica della contrattazione di Nash. I risultati in questione sono che l'equilibrio perfetto del gioco qui descritto soddisfa condizioni che possono essere considerate come la generalizzazione naturale di alcune delle proprietà imposte da Nash. La necessità di tali generalizzazioni nasce dal fatto che il nostro gioco è dinamico, mentre la teoria assiomatica della contrattazione è eminentemente statica.

Le prossime due brevi sezioni saranno riservate rispettivamente alla descrizione della teoria dei giochi a orizzonte infinito di Fudenberg-Levine (1983), e a presentare il gioco. Nella quarta sezione evidenzieremo le proprietà principali dell'equilibrio e nella quinta forniremo alcuni esempi di particolare interesse per la teoria economica.

2. *Equilibri perfetti nei giochi ad orizzonte infinito* [2]

Dobbiamo introdurre un po' di notazioni. Forniremo definizioni per giochi ad N persone, anche se successivamente ci occuperemo esclusivamente di giochi a due persone.

Assumiamo che ogni giocatore abbia un insieme di mosse possibili in ciascun periodo x_t^i. Quindi lo spazio delle mosse di tutti i giocatori al tempo t è il prodotto cartesiano: $x_t = \prod_{i=1}^{N} x_t^i$. Ora siamo in grado di introdurre le seguenti definizioni: una storia del gioco è la sequenza di mosse e contro-mosse di tutti gli agenti fino ad un certo punto nel tempo. Perciò una storia ha la forma:

$$\underline{x}_t = ((x_1^1, x_1^2, \ldots, x_1^N), \ldots, (x_T^1, x_T^2, \ldots, x_T^N)).$$

In ogni momento di tempo la storia deve essere possibile; cioè $\underline{x}_T \in H_T$, dove $H_T = \prod_{t=1}^{T} x_t$. Sia $H_T^i = \prod_{t=1}^{T} x_t^i$ l'insieme delle storie possibili per il giocatore i.

In ogni periodo tutti gli agenti devono scegliere una strategia. Questa scelta può essere rappresentata da una applicazione definita nel modo seguente:

$$g_{T+1}^i : H_T \to x_{T+1}^i.$$

L'insieme delle strategie al tempo T è detto lo spazio delle strategie dell'agente i ed è denotato: $S^i(T)$.

Sia g la strategia seguita da tutti gli agenti. Possiamo definire la funzione risultato $\underline{x}_T(g)$ come il risultato del gioco quando la storia iniziale è $\underline{x}_T$ e successivamente ogni giocatore gioca g.

Finalmente, siano g^{-i} le strategie seguite da tutti gli agenti tranne l'agente i e (g'^i, g^{-i}) sia la strategia nella quale l'agente i segue la strategia g' invece di g. Siamo ora in grado di introdurre la seguente:

DEFINIZIONE 2.1. $g^* \in S(T) = \prod_{i=1}^{N} S^i(T)$ è un equilibrio $\in$ perfetto (di sotto-gioco) per il gioco troncato in T se per ogni $t \geq 0$, storia x, strategia $g \in S(T)$ e giocatore i:

[2] In verità il lettore già a conoscenza di Fudenberg-Levine può saltare la presente sezione senza perdita di continuità.

$$(1) \qquad u_i (\underline{x}_t (g^i, g^{*-i})) - u_i (\underline{x}_t (g^*)) \leq \epsilon$$

cioè l'utilità del risultato d'equilibrio di ogni giocatore non può essere migliorata in nessun modo, qualunque sia stata la storia passata, per un valore maggiore di ϵ, date le strategie degli altri giocatori. Naturalmente se poniamo $\epsilon = 0$ si ottiene la definizione di equilibrio perfetto.

Possiamo infine enunciare senza dimostrazione il seguente teorema [3]:

TEOREMA DI FUNDENBERG-LEVINE (parte B). Se u_i sono uniformemente continue per una qualche metrica, una condizione necessaria e sufficiente affinché g^* sia un equilibrio perfetto in $S(\infty)$ è che ci siano sequenze $\epsilon(n)$, $T(n)$, e $g(n)$ tali che $g(n)$ sia un equilibrio ϵ-perfetto in $S(T(n))$ e al tendere di n ad infinito:

$$T(n) \to \infty; \ \epsilon(n) \to 0 \text{ e } g(n) \to g^*.$$

3. *Descrizione del modello di contrattazione*

Ci sono due giocatori, 1 e 2; ognuno possiede una funzione di utilità che denoteremo con v_i per distinguerla dalla funzione d'utilità attesa denotata con u_i. Tale funzione è nota (anche se non è necessariamente la stessa per i due giocatori) e soddisfa le seguenti condizioni:

(2i) $v_i (\underline{x}_1, \underline{x}_2, t) > v_i (\underline{x}_1, \underline{x}_2, \tau)$, per $t < \tau$, $\underline{x}_i \in X_i$, $\quad i = 1, 2, \ldots,$

(2ii) $\lim_{t \to \infty} v_i (\underline{x}_1, \underline{x}_2, t) = b_i$, $|b_i| < \infty$, $\underline{x}_i \in X_i$, $\quad i = 1, 2, \ldots,$

(2iii) $v_i (.)$ è limitata per ogni $\underline{x}_i \in X_i$ e t, $\quad i = 1, 2, \ldots,$

(2iv) $v_i (.)$ è continua in t per ogni $\underline{x}_i \in X_i$, t, $\quad i = 1, 2, \ldots,$

(2v) per ogni Δ è possibile trovare un $\eta < 1$ tale che:

$$v_i (., t + \Delta) < \eta \, v_i (., t) + (1 - \eta) \, b_i,$$

dove $\underline{x}_i$ è il livello di un insieme di variabili sotto il controllo dell'agente i, mentre X_i è un sottoinsieme di uno spazio vettoriale. Le condizioni precedenti non sono particolarmente restrittive e non necessitano particolari spiegazioni, con l'eccezione della (2*v*), che implica che possa essere trovato un limite inferiore al tasso di decrescita di $v_i (.)$. Notiamo che non stiamo assumendo funzioni di utilità rappresentanti lo stesso ordinamento di pre-

[3] La dimostrazione è contenuta in FUDENBERG-LEVINE (1983).

ferenze su $X = X_1 \times X_2$ in differenti momenti di tempo, né tantomeno funzioni d'utilità trasferibili. In questo senso il modello può essere pensato come una generalizzazione di quello di Rubinstein (1982).

Il gioco si svolge nel modo seguente. Al tempo 0 il giocatore 1 fa una domanda in termini d'utilità attesa. Il giocatore 2 l'accetta o meno. Se l'accetta, il gioco è finito. Altrimenti farà una domanda in termini d'utilità attesa dopo un periodo pari a Δ. Ora è il giocatore 1 che deve o meno accettare tale richiesta; se accetta il gioco è terminato; altrimenti dopo un periodo pari a Δ il gioco prosegue come in $t = 0$. Se non è affermato il contrario Δ è posto uguale a 1. Lo spazio delle strategie in ogni stadio del gioco è quindi uguale allo spazio delle utilità attese di ciascun periodo.

4. *Proprietà dell'equilibrio*

Prima di enunciare il teorema fondamentale circa l'esistenza ed unicità dell'equilibrio per il gioco sopra descritto, citiamo alcune proprietà dell'equilibrio perfetto la cui dimostrazione è molto facile e perciò sarà omessa.

Innanzi tutto se supponiamo che i giocatori possano accordarsi anche su funzioni di probabilità congiunte sullo spazio delle mosse possibili in ogni momento, allora la frontiera Pareto ottimale in senso forte in termini d'utilità attese, ad ogni determinato tempo t, è una funzione continua, decrescente e concava. Secondariamente per la (2i), se $\Phi(u_1, t)$ definita per $u_1 \in [\underline{u}_1(t), \bar{u}_1(t)]$, denota la frontiera Pareto ottimale in senso forte al tempo t, non è possibile che esistano due punti u_1', $u_2' = \Phi(u_1', t + \Delta)$ per i quali valgono simultaneamente le due diseguaglianze: $u_1' > u_1$ e $u_2' > u_2$. Di più, la struttura del gioco è tale per cui, se l'accordo è raggiunto al tempo t, esso si troverà sulla frontiera Pareto ottimale corrispondente. Infatti (ad esempio) se il giocatore i fa una domanda in termini della propria utilità attesa, è irrazionale per j accettare senza richiedere per sé il massimo livello d'utilità attesa compatibile con la domanda di i. Quindi possiamo trattare il gioco come se l'insieme delle mosse possibili fosse quello dei punti sulla frontiera Pareto ottimale forte. Infine l'equilibrio perfetto del gioco non muta per trasformazioni affini (lineari) della funzione d'utilità. Per questo motivo d'ora in poi normalizzeremo il gioco in modo tale che lo status quo si trovi sempre nell'origine.

Per le considerazioni appena svolte sembra naturale trattare separatamente i giochi in cui $\underline{u}_1(t) = 0$ e $\Phi(\bar{u}_1(t), t) = 0$ per ogni t. Per comodità notazionale adotteremo inoltre le seguenti convenzioni:

(3i) $$\Phi_1(u_2, t) = \Phi^{-1}(u_2, t),$$

(3ii) $$\Phi_2(u_1, t) = \Phi(u_1, t).$$

Nella figura 1 rappresentiamo gli equilibri perfetti dei giochi troncati al

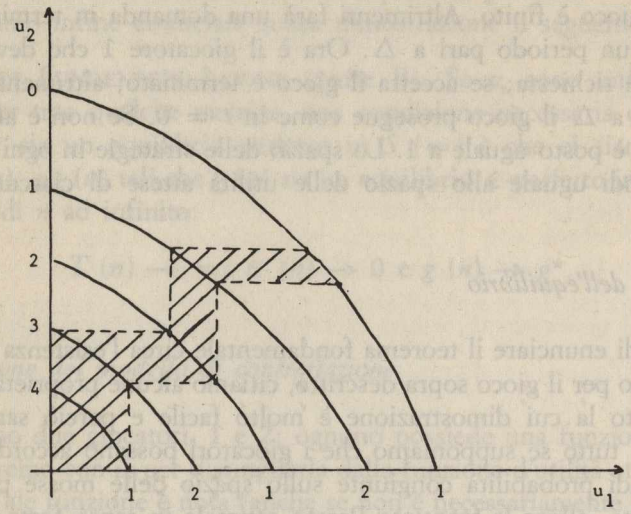

FIGURA 1

periodo 4 e 3. Nell'asse verticale abbiamo anche annotato il periodo della contrattazione, mentre nell'asse orizzontale abbiamo segnalato quale giocatore deve effettuare una proposta. L'equilibrio del gioco troncato al periodo 4 è rappresentato dalla linea tratteggiata inferiore, mentre quello troncato al periodo 3 da quella superiore. Il loro significato è il seguente: nessun agente accetterà in questo periodo un livello d'utilità inferiore a quello che può assicurarsi in quello successivo; il giocatore che deve fare una proposta sceglierà il più alto livello d'utilità fra quelli che soddisfano il precedente vincolo.

È anche possibile dimostrare che questi equilibri sono unici. Si assuma per esempio $T = 4$ e si assuma che la storia passata non abbia condotto ad alcun accordo fino a $t = 3$. Possiamo vedere alla Figura 2 che l'unico equilibrio perfetto è $(b, 0)$, poiché punti come c sono impossibili e punti come (a, e) non sono equilibri. Infatti non è ottimale per il giocatore 2 rifiutare allocazioni d'utilità comprese tra 0 ed e, perché al periodo successivo riceve comunque un'utilità nulla. In tal caso non è ottimale per il giocato-

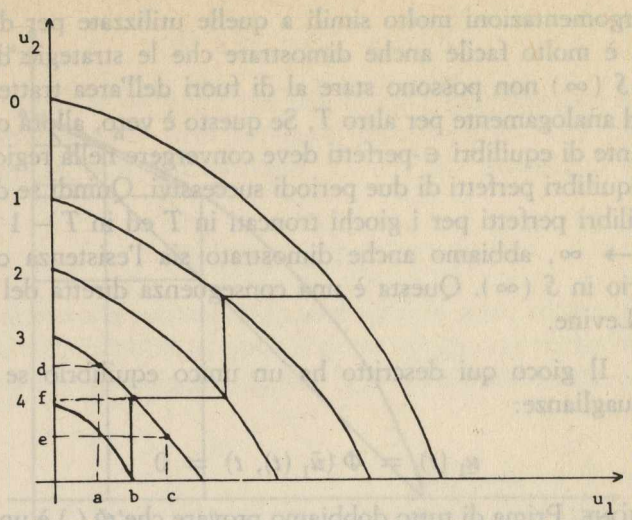

FIGURA 2

re 1 domandare meno di b. Siccome in caso di disaccordo in $t = 3$, il risultato è $(b, 0)$, in caso di disaccordo in $t = 2$, il risultato d'equilibrio non può essere che (b, f). Non può essere (a, d) perché se 1 rifiuta può ottenere b al periodo successivo. Non può essere (e, c), poiché se non è stato raggiunto alcun accordo in $t = 2$ ed in 3 il giocatore 2 domanda un livello d'utilità compreso fra b ed e, la strategia di 1 di rifiutare non sarebbe ottimale. Questa argomentazione può essere estesa a tutti i precedenti periodi. Inoltre possiamo generalizzare questa procedura ad ogni altro T ed abbiamo che il risultato corrispondente all'equilibrio perfetto del gioco per il giocatore 1 è:

$$(4)\quad u_1 = \Phi_1(\Phi_2(\ldots(\Phi_1(\Phi_2(y, T-1), T-2)\ldots), 1), 0) = F(y, T)$$

dove:

$$(5)\qquad y = 0 \text{ se il gioco è troncato in } T-1,$$

$$(6)\qquad y = \bar{u}_1(T) \text{ se il gioco è troncato in } T.$$

dove $T = 2n$, $n = 1, 2, 3, \ldots$.

Possiamo riassumere le precedenti argomentazioni nel seguente:

LEMMA 4.1. Ogni gioco troncato di contrattazione possiede un unico equilibrio il cui risultato per il giocatore 1 è dato da (4) – (6).

Con argomentazioni molto simili a quelle utilizzate per dimostrare il lemma 4.1. è molto facile anche dimostrare che le strategie di equilibrio perfetto in $S(\infty)$ non possono stare al di fuori dell'area tratteggiata della Figura 1, ed analogamente per altro T. Se questo è vero, allora ogni sequenza convergente di equilibri ϵ-perfetti deve convergere nella regione compresa fra due equilibri perfetti di due periodi successivi. Quindi se dimostriamo che gli equilibri perfetti per i giochi troncati in T ed in $T-1$ convergono quando $T \to \infty$, abbiamo anche dimostrato sia l'esistenza che l'unicità dell'equilibrio in $S(\infty)$. Questa è una conseguenza diretta del teorema di Fudenberg-Levine.

LEMMA 4.2. Il gioco qui descritto ha un unico equilibrio se valgono le seguenti uguaglianze:

$$\underline{u}_1(t) = \Phi(\bar{u}_1(t), t) = 0 \tag{7}$$

DIMOSTRAZIONE. Prima di tutto dobbiamo provare che $\Phi(.)$ è uniformemente continua in u. Facciamo riferimento alla Figura 3. Le forme funzionali delle tre linee *ab*, *ac* e *ad* sono rispettivamente:

$$u_2 = a - c_1 u_1, \tag{8}$$

$$u_2 = a - c_2 u_1, \tag{9}$$

$$u_2 = a - c_3 u_1. \tag{10}$$

dove:

$$a > 0,\ c_3 \geq c_2 \geq c_1 \geq 0. \tag{11}$$

Da cui si ricava:

$$\Phi(u_1') - \Phi(u_2'') = a - c_1 u_1' - a + \\ + c_2 u_1'' \leq c_1 (u'' - u') \leq c_3 (u_1'' - u_1'). \tag{12}$$

Se poniamo:

$$c_t = (\bar{u}_1(t)/\Phi(0, t))^i, \tag{13}$$

dove $i = 1 - 4(T/2 - \text{INT}(T/2))$, cioè $i = 1$ se t è pari e $i = -1$ altrimenti, per induzione si può facilmente dimostrare:

$$F(\bar{u}_1(T), T) - F(0, T) < \prod_{t=0}^{T-1} c_t \bar{u}_1(T) = K(T), \tag{14}$$

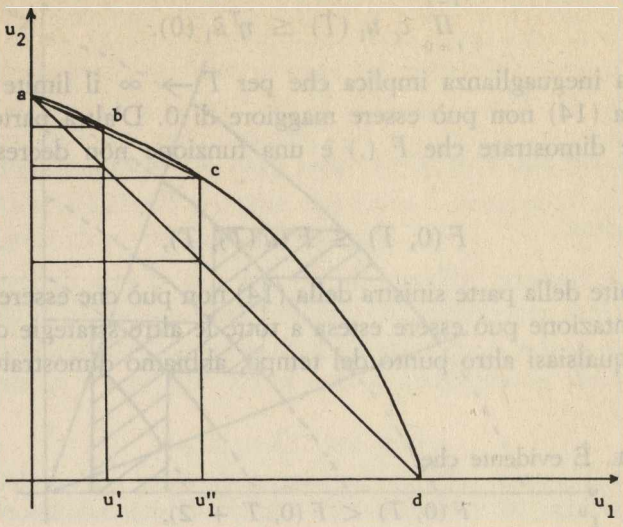

FIGURA 3

dove F (*) è stata definita nella (4), $T = 2n$, $n = 1, 2,...$ Possiamo derivare:

(15) $$K(T) = K(T-2)\, c_{T-2}\, c_{T-1}\, (\bar{u}_1(T)/\bar{u}_1(T-2)).$$

Dalla ($2v$) e dalla (13) abbiamo:

(16) $$K(T) \leq K(T-2)\, \eta^2.$$

(16) deriva dal fatto che $u(t)$ è la soluzione del problema di programmazione:

(17) $$\max_F \underset{F}{E}\, (v_i(.,t)),$$

dove $u(t) = (0, t)$. Il massimo è certamente raggiunto per qualche strategia pura, non necessariamente unica. Se l'insieme di strategie pure che risolvono (17) sono le stesse in T e in $T+1$, allora (16) deriva direttamente da ($2v$). Se i due insiemi sono differenti, allora questo significa che per qualche punto $(\underset{\sim}{x}_1, \underset{\sim}{x}_2)$ che massimizza u_i in $T+1$ vale la seguente:

(18) $$\bar{u}_i(T+1) \leq \eta v_i(\underset{\sim}{x}_1, \underset{\sim}{x}_2, T+1) < \eta \bar{u}_2(T).$$

Infine da (16) possiamo scrivere per induzione:

$$\prod_{t=0}^{T-1} c_t \, u_1(T) \leq \eta^T \bar{u}_1(0). \tag{19}$$

Quest'ultima ineguaglianza implica che per $T \to \infty$ il limite della parte sinistra della (14) non può essere maggiore di 0. D'altra parte siccome è molto facile dimostrare che $F(.)$ è una funzione non decrescente in y, avremo:

$$F(0, T) \leq F(u(T), T), \tag{20}$$

quindi il limite della parte sinistra della (14) non può che essere 0. Siccome tale argomentazione può essere estesa a tutte le altre strategie di equilibrio perfetto in qualsiasi altro punto del tempo, abbiamo dimostrato il lemma. Q.E.D.

ANNOTAZIONE. È evidente che:

$$F(0, T) < F(0, T + 2), \tag{21}$$

$$F(\bar{u}_1(T), T) > F(\bar{u}_1(T + 2), T + 2). \tag{22}$$

(20)-(22) implicano che il giocatore che gioca per ultimo gode d'un vantaggio contrattuale e può piegare il risultato del gioco in suo favore, ma tale vantaggio decresce al crescere di T, il momento di tempo in cui il gioco è troncato.

A questo punto siamo in grado di enunciare il nostro:

TEOREMA 4.1. Il gioco qui descritto possiede uno ed un solo equilibrio.

DIMOSTRAZIONE. Se vale la (7) il teorema è già stato dimostrato. Prima di trattare del caso generale è opportuno dimostrare altri due casi particolari.

a) $\underline{u}_1(t) < 0$, $\Phi(\bar{u}_1(t), t) < 0$, per ogni t.

In ogni punto al di fuori dell'ortante positivo un giocatore è senza dubbio in condizione peggiore rispetto al punto di disaccordo. È quindi certo che le strategie d'equilibrio perfetto non potranno trovarsi in tali punti, quindi la dimostrazione può seguire gli stessi passi del lemma precedente.

b) $\underline{u}_1(t) > 0$, $\Phi(\bar{u}_1(t), t) > 0$, per ogni t.

Come al solito forniamo una figura per agevolare la dimostrazione. Questa classe di giochi può essere rappresentata, infatti, come in Figura 4.

Possiamo pensare questi giochi come analoghi a quelli discussi al lemma precedente, ad eccezione del fatto che qualche strategia non è disponibile ai giocatori. L'interpretazione del gioco non influenza il suo equilibrio. Ad

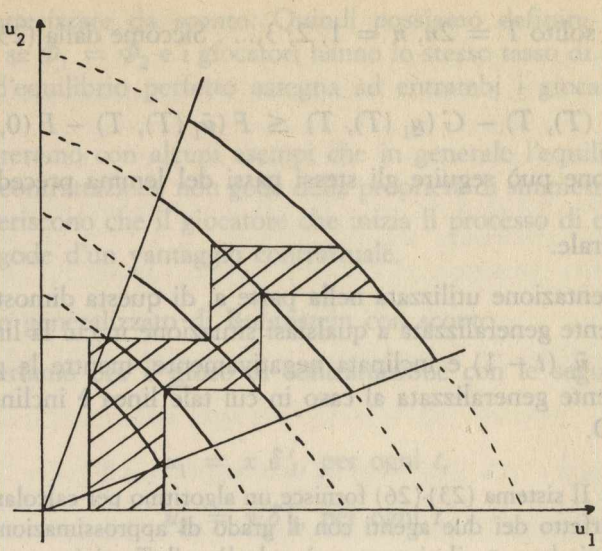

FIGURA 4

ogni modo se interpretiamo il gioco nel modo precedente possiamo sempre prolungare la frontiera Pareto ottimale fino ad incontrare i due assi, come illustrato dalle parti punteggiate delle curve in Figura 4. D'ora in poi dobbiamo cambiare leggermente le nostre convenzioni notazionali. Φ (.) denoterà la frontiera Pareto ottimale in senso forte del gioco allargato. Se per un determinato t non c'è alcun bisogno d'allargare la frontiera Pareto ottimale in senso forte, allora quella del gioco allargato sarà identica a quella del gioco originale. $\underline{u}_1(t)$ e $\bar{u}_1(t)$ denoteranno invece i valori minimali e massimali di u_1 al tempo t del gioco originario. Analogamente $\Phi(\bar{u}_1(t), t)$ e $\Phi(\underline{u}_1(t), t)$ saranno quelle di u_2 e saranno anche denotati rispettivamente $\underline{u}_2(t)$ e $\bar{u}_2(t)$. Ora possiamo scrivere l'analogo di (4)-(6) nel seguente modo:

$$(23)\quad G(u_1, T) = \Psi_1(\Psi_2(\ldots(\Psi_1(\Psi_2(u_1, T-1), T-2)\ldots), 1), 0),$$

dove:

$$(24)\quad \Psi_i(z, t) = \min[\Phi_i(z, t), \bar{u}_i(t)],$$

$$(25)\quad u_1 = \underline{u}_1(T) \text{ se il gioco è troncato in } T-1,$$

$$(26)\quad u_1 = \bar{u}_1(T) \text{ se il gioco è troncato in } T,$$

dove come al solito $T = 2n$, $n = 1, 2, 3, \ldots$. Siccome dalla (23) e dalla (4) deriva la:

$$(27) \quad G(\bar{u}_1(T), T) - G(\underline{u}_1(T), T) \leq F(\bar{u}_1(T), T) - F(0, T),$$

la dimostrazione può seguire gli stessi passi del lemma precedente.

c) Caso generale.

L'argomentazione utilizzata nella parte a. di questa dimostrazione può essere facilmente generalizzata a qualsiasi situazione in cui la linea congiungente $\bar{u}_i(t)$ e $\bar{u}_i(t-1)$ è inclinata negativamente, mentre la parte b. può essere facilmente generalizzata al caso in cui tale linea è inclinata positivamente. Q.E.D.

ANNOTAZIONE. Il sistema (23)-(26) fornisce un algoritmo per calcolare le strategie d'equilibrio perfetto dei due agenti con il grado di approssimazione desiderato. Infatti, per ogni dato ϵ, il sistema può calcolare il T minimo e un equilibrio $\epsilon(T)$ perfetto associato tale che $\epsilon(T) \leq \epsilon$, dove $\epsilon(T)$ è la distanza massima fra le strategie di equilibrio perfetto del gioco troncato in T e quello troncato in $T - 1$.

L'algoritmo utilizzato ha due conseguenze di facile dimostrazione, che perciò verrà omessa. Innanzi tutto l'accordo viene raggiunto al tempo 0, risultato che può essere dimostrato con argomentazioni analoghe a quelle usate a proposito del Lemma 4.1. Inoltre l'equilibrio è indipendente da alternative irrilevanti. Questo significa che se Γ è un gioco di contrattazione e g^* è il suo equilibrio perfetto e Γ' è un gioco identico al precedente ad eccezione del fatto che $S'(\infty) \subseteq S(\infty)$, inoltre se $g^* \in S'(\infty)$, allora g^* è l'equilibrio perfetto anche per Γ. Se infatti denotiamo con $S(T, \infty)$ lo spazio di strategie possibili da T fino ad infinito ed inoltre denotiamo con Γ'_T la classe di giochi definita poco sopra per i quali $S'(T, \infty) = S(T, \infty)$ è facile dimostrare che se la proprietà vale per Γ'_T vale anche per Γ'_{T+1}. Inoltre sicuramente vale per Γ'_1 quindi per induzione è possibile dimostrare la proprietà.

5. *Alcuni esempi*

Finora abbiamo dimostrato che l'equilibrio perfetto del gioco di contrattazione qui presentato possiede molte proprietà che possono essere pensate come generalizzazioni del concetto di soluzione di Nash. Più precisamente esso esiste, è unico, Pareto ottimale (in senso forte), indipendente da trasformazioni lineari e da alternative irrilevanti: ancora non sappiamo, però, se esso è anche simmetrico. In questa sezione tratteremo soltanto di funzioni

d'utilità caratterizzate da sconto. Quindi possiamo definire la simmetria come segue: se $\Phi_1 = \Phi_2$ e i giocatori hanno lo stesso tasso di sconto, allora il risultato d'equilibrio perfetto assegna ad entrambi i giocatori la stessa utilità.

Dimostreremo con alcuni esempi che in generale l'equilibrio perfetto del gioco di contrattazione non gode della proprietà di simmetria. Inoltre gli esempi suggeriscono che il giocatore che inizia il processo di contrattazione in generale gode d'un vantaggio contrattuale.

a. Il modello generalizzato di Rubinstein con sconto.

Consideriamo ora il gioco di contrattazione con le seguenti funzioni d'utilità:

$$u_1 = x\,\delta_1^t, \text{ per ogni } t, \tag{28}$$

$$u_2 = y\,\delta_2^t, \text{ per ogni } t, \tag{29}$$

$$y = \Phi(x), \text{ per ogni } t, \tag{30}$$

Per questo genere di gioco è possibile provare il seguente lemma:

LEMMA 5.1. Se le funzioni di utilità soddisfano le (28)-(30) e se x^*, $\Phi(x^*)$ è il risultato di equilibrio perfetto per il gioco, assumendo che i giocatori comincino la contrattazione al tempo t, esso sarà anche il risultato di equilibrio perfetto se i giocatori cominciano la contrattazione al tempo $t + 2$.

DIMOSTRAZIONE. Il lemma è una stretta conseguenza della proprietà d'indipendenza da trasformazioni lineari, infatti è sufficiente moltiplicare le funzioni di utilità del gioco che parte da $t + 2$ rispettivamente per δ_1^{-2} e δ_2^{-2} e otterremo il gioco che parte da t. Q.E.D.

Inoltre, possiamo osservare che se al tempo 0 il giocatore 1 effettua una domanda in termini di utilità attesa e al tempo 1 l'equilibrio perfetto gli garantisce y^1, allora l'equilibrio perfetto per il giocatore 2 al tempo 0 sarà:

$$\Phi(x^o) = \Phi(y^1)\,\delta_2. \tag{31}$$

Analogamente, se al tempo 2 l'equilibrio perfetto garantisce al giocatore 2 x^2, l'equilibrio perfetto al tempo 1 gli garantisce:

$$y^1 = x^2\,\delta_1. \tag{32}$$

Per il Lemma 5.1 abbiamo che $x^o = x^2 = x$, da cui:

$$\Phi(x) = \Phi(x\,\delta_1)\,\delta_2 \tag{33}$$

definisce il risultato d'equilibrio perfetto quando il giocatore 1 inizia la contrattazione.

È anche possibile ricavare una dimostrazione analoga per il gioco in cui è il giocatore 2 a iniziare la contrattazione e troviamo che i due equilibri perfetti sono rispettivamente la soluzione per x e la soluzione per y del sistema:

$$y = x\,\delta_1, \tag{34}$$

$$\Phi(x) = \Phi(y)\,\delta_2. \tag{35}$$

Se semplifichiamo ulteriormente il sistema (28)-(30) nel seguente:

$$u_1 = x\,\delta_1^t, \text{ per ogni } t, \tag{36}$$

$$u_2 = y\,\delta_2^t, \text{ per ogni } t, \tag{37}$$

$$x = 1 - y,\ 0 \leq y \leq 1, \text{ per ogni } t. \tag{38}$$

otteniamo evidentemente il gioco di Rubinstein con sconto. Il risultato d'equilibrio perfetto, a seconda che il processo di contrattazione sia iniziato dal giocatore 1 o dal giocatore 2, sarà rispettivamente determinato dalla soluzione per x e dalla soluzione per y del seguente sistema:

$$y = x\,\delta_1, \tag{39}$$

$$x = 1 - \delta_2 + y\,\delta_2. \tag{40}$$

Le due soluzioni sono:

$$x = (1 - \delta_2)/(1 - \delta_1\,\delta_2), \tag{41}$$

$$y = \delta_2\,(1 - \delta_1)/(1 - \delta_1\,\delta_2)\ ^4, \tag{42}$$

che chiaramente non rispettano le condizioni di simmetria. Finora abbiamo dimostrato che in generale il gioco non è simmetrico. Sarebbe interessante trovare una classe generale di giochi i quali abbiano per lo meno approssimativamente questa proprietà. L'intuito suggerisce un primo candidato in quei giochi nei quali l'intervallo di contrattazione, cioè, il periodo di tempo tra uno stadio del processo di contrattazione e l'altro, tende a 0.

b. Il modello generalizzato di Rubinstein con sconto e intervalli di contrattazione indefinitamente piccoli.

[4] In verità il risultato vale solo se $0 \leq \delta_i \leq 1$, $i = 1, 2,...$ Per i dettagli si confronti RUBINSTEIN (1982).

Denominiamo con Δ l'intervallo di tempo tra uno stadio della contrattazione e il seguente. Possiamo trasformare la nostra variabile originale indicante il tempo come segue:

$$t = \Delta s. \tag{43}$$

Il modello è quello presentato in (28)-(30) ma, per convenienza matematica, imponiamo: $\delta_1 = e^{-\alpha\Delta}$ e $\delta_2 = e^{-\beta\Delta}$. Inoltre assumiamo che Φ (.) sia differenziale in un intorno dell'equilibrio. Ora possiamo scrivere la (33) nel seguente modo:

$$\Phi(x) = \Phi(xe^{-\alpha\Delta})\, e^{-\beta\Delta}. \tag{44}$$

Possiamo differenziare la (44) rispetto a Δ e ottenere

$$\Phi'(x)\, x' = -\beta\Phi(xe^{-\alpha\Delta})\, e^{-\beta\Delta} + \Phi'(xe^{-\alpha\Delta})\,(x'\, e^{-\alpha\Delta} - \alpha x e^{-\alpha\Delta})\, e^{-\beta\Delta}. \tag{45}$$

Il limite della (45) per $\Delta \to 0$, dopo alcune semplificazioni, è:

$$\beta y/\alpha x = -\Phi'(x), \tag{46}$$

$$y = \Phi(x). \tag{47}$$

In questo caso il sistema (46)-(47) caratterizza completamente il limite del nostro equilibrio perfetto, e ovviamente soddisfa la nostra condizione di simmetria.

ANNOTAZIONE. Nella sezione precedente abbiamo visto che questo gioco per T finito attribuisce un "potere" al giocatore che gioca per ultimo. Questa proprietà è molto ben conosciuta nei giochi di Stackelberg a somma zero ed è stata conservata nell'attuale gioco che può essere pensato come un gioco alla Stackelberg ripetuto. Abbiamo visto che la "asimmetria" da ultima mossa scompare se $T \to \infty$. In giochi con sconto abbiamo visto che vi è anche un'altra forma di asimmetria: quella da prima mossa. Il primo giocatore ha un vantaggio perché deve scontare per meno tempo. L'asimmetria scompare al tendere di Δ a 0, ma è importante sottolineare che se i due giocatori fanno le loro richieste e decidono se accettare le richieste dell'altro simultaneamente, il gioco ha infiniti equilibri. Perciò un certo grado di asimmetria è necessario per ottenere i risultati della sezione precedente, anche se possiamo rendere questa asimmetria piccola a piacere.

Infine, si può facilmente dimostrare che il sistema (46)-(47) è la soluzione del seguente problema:

$$\max x^{1/\alpha}\, y^{1/\beta}$$

(48) $\qquad$ s.t. $y = \Phi(x)$.

Dovrebbe essere chiaro che la soluzione del problema (48), non è simmetrica in senso statico, dato che le utilità dei due giocatori sono ponderate dall'inverso dei rispettivi tassi istantanei di sconto. Il sistema (48) è noto, nell'approccio assiomatico, come la soluzione asimmetrica [5] ed i due pesi sono di solito interpretati come indici del potere, o della capacità di contrattazione, dei due agenti. Qui la capacità di contrattazione dei due agenti è data dalla loro stessa capacità di aspettare, sintetizzata dall'inverso del tasso istantaneo di sconto. La razionalità di questo risultato è la seguente: quanto più alto è il valore del futuro per un agente, tanto meno efficace sarà la minaccia dell'altro di non voler giungere ad un accordo nel presente periodo.

6. *Conclusioni*

In questo articolo abbiamo analizzato una sorta di versione generalizzata del modello di contrattazione di Rubinstein e siamo riusciti a dimostrare l'esistenza e l'unicità dell'equilibrio. La dimostrazione si è servita del teorema di Fudenberg e Levine sugli equilibri perfetti in giochi ad orizzonte infinito visti come il limite di una serie di equilibri ϵ-perfetti. La dimostrazione fornisce anche una tecnica per il calcolo delle strategie di equilibrio ad ogni desiderato livello di approssimazione.

Lo scopo principale di questo articolo è stato quello di confrontare le proprietà dell'approccio strategico di Rubinstein con quello assiomatico. Il risultato è stato che l'equilibrio del nostro gioco evidenzia molte delle proprietà dei concetti di soluzione proposti nell'approccio assiomatico. Oltre ad essere unico è anche Pareto-ottimale in senso stretto, indipendente da trasformazioni lineari e da alternative irrilevanti. Alcune di queste proprietà sono state ridefinite per essere compatibili con il nuovo contesto dinamico. Nella definizione di Pareto-ottimalità abbiamo dovuto aggiungere esplicitamente la proprietà secondo la quale un accordo deve essere raggiunto nel primo periodo.

Con pochi esempi abbiamo dimostrato che il nostro gioco non è simmetrico: in generale il giocatore che inizia la contrattazione ha un vantaggio. Questo è stato fatto attraverso la computazione dell'equilibrio nel semplice caso di sconto, sia nel modello di Rubinstein, sia in una versione leggermen-

[5] ROTH (1979, pp. 15-19). L'autore ha anche dimostrato che il sistema (48) caratterizza il risultato d'equilibrio perfetto anche nel caso Φ (*) non sia differenziabile.

te generalizzata. Abbiamo anche provato che nel caso in cui l'intervallo tra il passo della contrattazione e il successivo tende a 0, l'equilibrio perfetto di questi giochi converge ad una soluzione simmetrica. Infine, nel caso di sconto e di intervalli di contrattazione indefinitamente piccoli, possiamo derivare endogenamente una sorta di funzione del benessere.

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SELTEN R., "Re-examination of the Perfectness Concept for Equilibrium Points in Extensive Form Games", *International Journal of Game Theory*, 1975, *4*, 22-55.

AXIOMATIC AND STRATEGIC THEORIES OF BARGAINING: A COMPARISON OF RESULTS

This paper generalizes Rubinstein's (1982) bargaining model to less restrictive utility functions than those he considered. The author succeeds in obtaining the existence and uniqueness of the equilibrium. The proof uses Fudenberg-Levine's (1983) theory of infinite horizon games and it is constructive. This means that it can provide an algorithm for calculating the perfect equilibrium strategies with any degree of approximation. The perfect equilibrium has some properties which can be thought of as extensions of those of Nash's solution concept. The properties are: Pareto optimality, independence of linear transformations and independence of irrelevant alternatives. In the case of discounting, the perfect equilibrium is certainly asymmetric. If the interval between one step of the bargaining and the next approaches zero, the perfect equilibrium tends to a symmetric outcome, at least in a dynamic sense.

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TRADE IMBALANCE, THE FACTOR PROPORTIONS THEORY AND THE RESOURCE CONTENT OF INTERNATIONAL TRADE

by
F.R. Casas * and E.K. Choi **

Abstract

This paper shows how a trade imbalance can distort the pattern of commodity trade and cause a reversal of indirect factor trade, so that neither the factor intensity ranking of the export and import bundles nor the sign of net resource flows may be relied upon to reveal a country's factor abundance. Using the ratio of trade surplus or deficit to income as a yardstick, we demonstrate that the U.S. would have exported capital and imported labor had trade been balanced in 1947 and hence the Leontief Paradox is attributable to the U.S. 1947 trade surplus.

I. *Introduction*

Although the central theme of the Heckscher-Ohlin theory of the determinant of the pattern of international trade has been to relate the factor intensity ranking of traded commodities to the trading countries' resource endowments, a major focus of attention in the last three decades has been the direction and the composition of intercountry flow of resources embodied in traded goods [1]. An important stimulus to this theoretical devel-

* University of Toronto, Department of Economics, Toronto, Ontario (Canada).
** Iowa State University, Ames, Iowa (U.S.A.).

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[1] See for example Vanek (1968, 1971) and Horiba (1971, 1974). A related issue which has also drawn considerable discussion is the factor price equalization theory.

opment was provided by the need to extend the factor proportions theory beyond the conventional two-good, two-factor model in the wake of Leontief's (1953, 1956) empirical finding that U.S. import replacements had been capital intensive relative to American exports in 1947 and 1951. Following the publication of Leontief's results and those of a series of similar studies, a number of attempts were made to explain what had become known as the Leontief Paradox. While it is not within the scope of this paper to survey these empirical studies and the explanatory theories they fostered [2], it may be pointed out that the latter fell into two broad categories: either the paradox indicated that the U.S. pattern of trade was not primarily determined by the nation's relative factor abundance [3], or the paradox might be resolved within the framework of the factor proportions theory itself [4].

Among the latter group of explanations, the possibility that Leontief's finding did not reveal a scarcity of capital in the U.S. as much as it reflected a scarcity of natural resources came under close scrutiny [5], particularly since the U.S. had been indirectly exporting both capital and labor during the periods covered by the studies [6]. It was important therefore to extend the scope of the factor proportions theory to cover the multi-factor as well as the multi-good cases – since in the latter case the pattern of domestic resource allocation, and hence of commodity trade, may be indeterminate [7] –, in order to compare the results with those derived from the simple model and to develop testable hypotheses in terms of the factor intensity ranking of traded commodities and/or the pattern of indirect factor trade.

Relatively little attention, however, has been given to the implications of trade imbalances on the volume and the composition of a country's external commodity exchange and to the difficulties such imbalances may raise in an empirical test of the relevance of the factor proportions theory

[2] The interested reader is referred to BALDWIN (1971).

[3] This includes the possibility that the U.S. pattern of trade might reflect international differences in technology or tastes, the existence of domestic market imperfections, or increasing returns to scale.

[4] It may be, for example, that U.S. exports would have been revealed capital intensive if capital had been defined to include human as well as physical capital, or U.S. exports may be skill intensive or R & D intensive, etc.

[5] See for example DIAB (1956), VANEK (1959, 1963) and TRAVIS (1964).

[6] BALDWIN (1971) has shown that this was also the case for American trade in 1962. However, MITCHELL (1975), STERN and MASKUS (1981), and MASKUS (1983) have documented the shifts which have occurred in the commodity composition and the factor content of U.S. trade during the 1960's, which pushed that country's trade pattern by the early 1970's into conformity with the predictions of the Heckscher Ohlin theory.

[7] See SAMUELSON (1953), MELVIN (1968), HONG (1970), VANEK and BERTRAND (1971).

for any given country's trade pattern [8]. The purpose of this paper is to show that by distorting the pattern of commodity trade, a trade imbalance may reverse the factor intensity ranking of traded goods as well as the pattern of indirect factor trade.

In Section 2 we review the major characteristics of a country's foreign trade in a multi-good model in which trade is balanced and the pattern of trade is determined by international differences in relative factor endowments. In Section 3 we contrast these conventional results with those which would be obtained in the presence of a trade surplus or deficit, and we then use our findings to formulate in Section 4 a number of hypotheses which can be used to infer a country's factor abundance or scarcity. Section 5 applies the proposed tests to Leontief's data to demonstrate that his paradoxical finding can be attributed to the U.S. 1947 trade surplus. Section 6 contains a brief summary and conclusions.

II. *The Patterns of Commodity and Factor Exchange Under Balanced Trade*

Consider a country producing m commodities using n factors, with $m \geq n$. Assume that technologies are internationally identical and linearly homogeneous, that consumer preferences are also internationally identical and homothetic, and that product and factor markets are perfectly competitive. The following two propositions may then be established.

The Vanek-Williams Theorem: Under balanced trade a country will export the services of its abundant factors and import the services of its scarce factors [9].

With internationally identical and homothetic tastes, the domestic and world consumption vectors must be collinear under free trade, so that we may write

$$c_j = \alpha c_j', \tag{1}$$

where c_j and c_j' respectively denote the domestic and world consumption of the jth good, and α is the ratio of domestic to world expenditure [10]. Let y_j and y_j' denote the domestic and world production of the jth good. Since

[8] A notable exception is WILLIAMS (1970) whose contribution is discussed below.

[9] See LEAMER (1980) for an alternative version of this theorem using income shares.

[10] This follows from the fact that $C = \sum_j p_j c_j = \sum_j p_j \alpha c_j' = \alpha \sum_j p_j c_j' = \alpha C'$, where p_j is the price of the jth commodity, and C and C' are domestic and world consumption.

world consumption of any commodity must equal world output, equation (1) may be rewritten as

$$c_j = \alpha y_j'. \tag{2}$$

Given the assumption of internationally identical and linearly homogeneous technologies, and with the further stipulation that factor price equalization obtains under free trade [11], each commodity will be produced using the same input-output coefficients. Let I and I' denote the domestic and world supplies of input I ($I = K, L, \ldots$), and let I_t represent the amount of resource I the services of which are embodied in the home country's net exports. It is then readily shown with the use of equation (2) that

$$I_t = \sum_{j=1}^{m} a_{Ij} (y_j - c_j) = -I - \alpha I' \tag{3}$$

where a_{Ij} is the amount of factor I per unit of the jth good.

While the definition of relative factor abundance loses its simplicity in a many-factor world, it is convenient to use the definition proposed by Williams (1970) according to which a country is abundant (scarce) in resource I if the ratio of the country's endowment to the world endowment exceeds (falls short of) the ratio of domestic to world income, i.e., if $I/I' > (<)\ Y/Y'$, where Y and Y' are domestic and world income respectively [12]. Since under balanced trade domestic consumption and income are equal, $\alpha = Y/Y'$ so that equation (3) implies that

$$I_t \gtreqless 0 \qquad \text{iff} \qquad I/I' \gtreqless Y/Y', \tag{4}$$

that is, a country will export the services of its abundant factors and import those of its scarce factors under balanced trade [13].

---

[11] Since $m \geq n$, factor price equalization requires incomplete specialization in at least n commodities.

[12] This definition coincides with the familiar physical definition of factor abundance in the two-factor case since, for example, $K/K' > Y/Y' = (wL + rK)/(wL' + rK')$, where w and r are the prices of L and K respectively, if and only if $K/K' > Y/Y' > L/L'$.

[13] First formulated by WILLIAMS (1970), this result was recently rediscovered by BRECHER and CHOUDHRI (1982) who use the equivalent formulation $I_t \gtreqless 0$ if and only if $C/I \lesseqgtr C'/I'$. Earlier, VANEK (1968) had shown that if resources are ranked in order of decreasing domestic to world endowment ratios, I/I', the home country would export the services of the first t factors ($1 \leq t < n$) and import the services of the remaining $(n - t)$ factors, the value of t being determined by factor prices. WILLIAMS' (1970) formulation shows that Y/Y' is the value which breaks the chain of I/I' ratios into exported and imported factors. BERTRAND (1972) extended the analysis to cases where factor price equalization is not assumed and where the identical demand hypothesis is relaxed.

It is important to note that while it is true that if a country exports (imports) the services of a single factor, that country may unambiguously be identified as abundant (scarce) in the exported (imported) factor relative to all other factors, no such inference is possible where several factors are indirectly exported or imported under balanced trade. The pattern of factoral flows will reveal abundance (scarcity) of each exported (imported) resource relative to each imported (exported) factor, but not relative to other exported (imported) factors. The latter may be inferred from a comparison of the shares of domestic resources exported of imported since, as established by Vanek (1968) and as may be seen from equation (3), the ranking of the ratios of individual factors to domestic endowments I_t/I is the same as the ranking of the ratios of domestic to foreign endowements I/I'.

The Leontief-Leamer Theorem: If a country is abundant in factor U and scarce in factor V, then under balanced trade the country will export a commodity bundle characterized by a higher U/V ratio than the imported bundle. However, a higher U/V ratio for exports than for imports does not necessarily reflect abundance in U relative to V, except if U and V are the only two factors.

Even with two factors of production the domestic resource allocation is indeterminate when more than two goods are produced, raising the possibility that a country may import goods some of which are intensive in the use of one factor while others are intensive in the use of the second factor relative to exports, and vice-versa [14]. The pattern of a country's commodity trade is thus itself indeterminate in the sense that it is not possible to uniquely relate the ranking of individual traded goods in terms of their relative factor intensities to the country's relative factor endowment.

However, it can readily be shown that in the two-factor balanced trade case a country's export bundle must be relatively intensive in the use of the abundant factor while the import bundle must be intensive in the use of the scarce factor. To see this, let $I_x = \sum_{j=1}^{m} a_{Ij}\, x_j$ and $I_m = \sum_{j=1}^{m} a_{Ij}\, m_j$ represent the amounts of factor I embodied in gross exports (x_j) and imports (m_j) respectively, with

$$I_t = I_x - I_m. \tag{5}$$

[14] See Melvin (1968). Chacholiades (1978, pp. 288-90) provides a numerical example in which a country producing three goods imports the most and the least labor intensive commodities. It must be noted that for any set of commodity prices, a country's factor endowment may lead it to completely specialize in the production of a number of goods and to rely on imports for products some of which are more capital and others are more labor intensive than those supplied domestically. In such cases factor prices may not be equalized internationally. See Jones (1974).

If the two factors are denoted U and V, then either $U/U' > Y/Y' > V/V'$ or $U/U' < Y/Y' < V/V'$, so that (4) and (5) together imply

$$U_x/V_x \gtrless U_m/V_m \qquad \text{iff} \qquad U/U' \gtrless V/V'. \tag{6}$$

This formulation corresponds to the multi-commodity version of the factor proportions theory which Leontief (1953, 1956) tested in his studies of U.S. trade for 1947 and 1951 [15].

In the many-factor case, if a country exports the services of factor U and imports the services of factor V, the U/V ratio of that country's exports must exceed that of its imports. This will necessarily be the case for any pair of factors comprising an abundant resource and a scarce resource. However, *the converse of this proposition is not true*: the U/V ratio of a country's exports may exceed that of its imports even though the country has a relatively lower domestic to world endowment of resource U, provided both resources U and V are abundant or scarce in terms of Williams' definition or equivalently, if the services of both factors are exported or imported. As noted by Leamer (1980), when the services of two factors flow in the same direction, the ranking of the export and import bundles in terms of the ratios in which these two factors are used need not match the ranking of the country's endowment ratio relative to the world for the same two resources.

It follows that if two factors are observed flowing in opposite directions under balanced trade, the factor intensity ranking of the traded bundles in terms of those two factors would reveal the country's abundance in the exported factor relative to the imported factor. However, no inference may be drawn about relative factor abundance from the factor intensity ranking of traded bundles in terms of two factors which flow in the same direction. Leontief's data provide an example of the latter case since both labor and capital services were exported by the U.S. in 1947, so that it was inappropriate to infer the American relative capital or labor abundance from the ranking of the capital-labor ratios of U.S. exports and imports.

III. *Trade Imbalance and Factor Trade Flow Reversal*

Let us now consider the case where a country's trade with the outside world is not balanced. Given internationally identical and homothetic prefer-

[15] Leontief computed the ratios I_x/X and I_m/M, where $X = \sum_j p_j x_j$ and $M = \sum_j p_j m_j$, for capital and labor, and compared $[(K_x/X)/(L_x/X)]$ with $[(K_m/M)/(L_m/M)]$. Condition (6) was also derived by LEAMER (1980).

ences, a trade imbalance does not shift the world demand for any commodity since a country's surplus (deficit) must be exactly offset by the deficit (surplus) in the rest of the world. Thus a trade imbalance does not affect commodity and factor prices or the domestic allocation of resources, but given the assumption of homothetic preferences it would decrease (in the case of a trade surplus) or increase (in the case of a deficit) the consumption of all goods equiproportionately.

For factor and commodity exchange with a trade imbalance we can establish two propositions which are the counterparts of the Vanek-Williams and the Leontief-Leamer theorems:

Theorem 1: A trade imbalance may cause a reversal in a country's indirect factor trade flow. In particular, a surplus country may export its scarce factors and a deficit country may import its abundant factors.

Since the ratio of domestic to world expenditure, $\alpha = C/C'$, is no longer equal to the ratio of domestic to world income, Y/Y', when trade is not balanced, equation (3) now implies

$$I_t \gtreqless 0 \qquad \text{iff} \qquad (I/I') \gtreqless (C/Y)\,(Y/Y'). \tag{7}$$

It follows that

(i) if the home country has a trade surplus ($C < Y$), then I may be exported ($I_t > 0$) even though it is a scarce resource ($I/I' < Y/Y'$).

(ii) if the home country has a trade deficit ($C > Y$), then I may be imported ($I_t < 0$) even though it is an abundant resource ($I/I' > Y/Y'$).

However, it should be noted that a modified version of Vanek's (1968) result that a country exports its *relatively* abundant factors and import its *relatively* scarce factors remains valid. This is because equation (3) holds independently of the trade balance, so that the ranking of the shares of net exports of domestic factors, I_t/I, will again mirror that of the ratios of domestic to world endowements, I/I'. This implies that if under balanced trade a country would have exported the services of its t most abundant factors ($1 \leq t < n$) and imported those of the remaining $(n - t)$ resources, that country would export the services of its $s \geq t$ most abundant factors under a trade surplus, and may even export the services of all factors ($s \leq n$) in such a case. With a deficit, $s \leq t$ and the country might import the services of all factors ($s \geq 0$) .

It remains, however, that the resource content of a country's foreign trade becomes a less accurate reflection of its relative factor abundance when trade is not balanced. It will be still true that if two factors are observed to flow in opposite directions the home country is abundant in the exported factor relative to the imported factor. However, it is possible that

while relative abundance between two factors would be revealed under balanced trade if they flow in opposite directions, these factors may both be exported or imported when trade is not balanced. In the case of Leontief's data, for example, the U.S. had a considerable trade surplus, raising the possibility that the observation that both capital and labor were indirectly exported might be "explained" in terms of this imbalance and that either resource might have been imported if trade had been balanced.

Theorem 2: A trade imbalance may cause a reversal in the factor intensity ranking of a country's traded commodity bundles. In particular, even in a two-factor world a country's exports may be intensive in its scarce factor and imports may be intensive in its abundant factor.

A trade imbalance will affect the volume of a country's external trade flows and may also alter its pattern of commodity trade. Specifically, a surplus country may export goods which it would import under balanced trade, while a deficit country may import commodities which would have been imported under balanced trade. This follows from the fact that with an asterisk denoting the value of a variable under balanced trade as distinguished from its actual value, we may write

$$y_j = y_j^* \qquad \text{and} \qquad c_j = (C/Y)\, c_j^*, \tag{8}$$

so that

$$y_j - c_j \gtreqless y_j^* - c_j^* \qquad \text{iff} \qquad C \gtreqless Y. \tag{9}$$

It remains true that if the trade imbalance does not affect the pattern of indirect factor flows for two resources one of which is exported and the other is imported, inequality (6) would hold, even though the commodity composition of the export and import bundles might be different. It is in the case where a surplus (deficit) country exports (imports) two factors one of which would have been imported (exported) under balanced trade that the possibility exists of a reversal in the factor intensity ranking of exports and imports as a result of the trade imbalance.

Consider the following example. In Table 1 the input-output coefficients for each of three commodities are shown, together with domestic output y_j^*, consumption c_j^* and net exports $(y_j^* - c_j^*)$ for each commodity under balanced trade [16]. For simplicity, units have been defined to normalize all prices to unity. The country would then export commodity 3 and import commodities 1 and 2. The average capital-labor ratios of the export and import bundles would be

[16] Bracketed figures indicate negative values.

$$\frac{K_x^*}{L_x^*} = \frac{a_{K3}\,(y_3^* - c_3^*)}{a_{L3}\,(y_3^* - c_3^*)} = 2,$$

$$\frac{K_m^*}{L_m^*} = \frac{a_{K1}\,(y_1^* - c_1^*) + a_{K2}\,(y_2^* - c_2^*)}{a_{L1}\,(y_1^* - c_1^*) + a_{L2}\,(y_2^* - c_2^*)} = 1.4,$$

where K_x^* and L_x^* respectively denote the amount of capital and labor embodied in exports under balanced trade, and K_m^* and L_m^* are similarly defined for imports. A comparison of these two ratios would reveal this country's capital abundance. The same conclusion would be reached by observing that the country is a net exporter of capital services ($K_t = 50$) and a net importer of labor services ($L_t = -50$).

TABLE 1.

Industry	a_{Lj}	a_{Kj}	y_j^*	c_j^*	$y_j^* - c_j^*$	y_j	c_j	$y_j - c_j$
1	1	1	850	900	(50)	850	450	400
2	4/5	6/5	50	300	(250)	50	150	(100)
3	2/3	4/3	600	300	300	600	150	450

Assume now that this country incurs a trade surplus. As previously argued, the production vector would be unchanged at constant commodity prices. Commodity prices remain unchanged since imbalance does not affect world demand due to internationally identical and homothetic preferences. However, a trade surplus reduces the consumption of all goods equiproportionately. For the purpose of illustration, let consumption of all goods decline by fifty percent. The resulting levels of domestic production y_j, consumption c_j, and net exports $(y_j - c_j)$ are shown in the last three columns of Table 1.

The country would now be observed to export commodities 1 and 3, in exchange for imports of commodity 2. The average capital-labor ratios of the export and import bundles would become

$$\frac{K_x}{L_x} = \frac{a_{K1}\,(y_1 - c_1) + a_{K3}\,(y_3 - c_3)}{a_{L1}\,(y_1 - c_1) + a_{L3}\,(y_3 - c_3)} = 1.428,$$

$$\frac{K_m}{L_m} = \frac{a_{K2}\,(y_2 - c_2)}{a_{L2}\,(y_2 - c_2)} = 1.5,$$

so that $(K_x/L_x) < (K_m/L_m)$. That the factor intensity ranking of the traded bundles may not be an accurate indicator of the country's relative factor

abundance in this case is revealed by the fact that both capital ($K_t = 880$) and labor ($L_t = 620$) are indirectly exported.

IV. *Formulating Testable Hypotheses When Trade Is Not Balanced*

Since neither the indirect flows of resources for a country nor the factor intensity ranking of its export and import replacement bundles may be relied upon to reveal that country's relative factor abundance when trade is not balanced, is it possible to infer abundance from trade data? Because this problem arises only when more than one resource is exported or imported, we confine our discussion to such cases and consider three approaches.

(A) The first method involves ranking the factor intensities of domestic production, consumption and foreign trade and is closely related to Leamer's (1980) investigation of the Leontief Paradox [17]. Note that

$$I_t = \sum_{j=1}^{m} a_{Ij} (y_j - c_j) = I - I_c, \tag{10}$$

where I_c denotes the amount of factor I embodied in the domestic consumption bundle. With the help of equation (3) we may establish that for any two factors U and V,

$$U_t/U \gtrless V_t/V \quad \text{iff} \quad U/U' \gtrless V/V'. \tag{11}$$

Hence,

$$U_c/V_c \lessgtr U/V \quad \text{iff} \quad U/U' \gtrless V/V'. \tag{12}$$

It follows that a country which exports or imports the services of two factors, U and V, will be revealed abundant in U relative to V if domestic production is U-intensive relative to domestic consumption, and vice-versa. To establish *global* abundance in U (relative to all other factors) would require that domestic production be U-intensive compared to domestic consumption in terms of all other *exported* factors, or all other factors if none is exported. Conversely, global scarcity in U would be revealed if domestic consumption is U-intensive compared to domestic production in terms of all other imported factors. Equivalently, global abundance (scarcity) in U would be revealed if the ratio of domestic consumption to endowment,

[17] Leamer discusses the possibility that a country may indirectly export or import two resources, capital and labor, in exchange for a third resource rather than as a result of a trade imbalance.

U_c/U, is smaller (larger) than the corresponding ratios for all other exported (imported) factors.

Alternatively, we may wish to compare the factor intensity of a country's *net* trade bundle with that of the domestically produced or consumed bundles. It is then possible to use either of the following tests.

(i) A country which exports (imports) resources U and V will be revealed abundant in U relative to V if trade is U–(V–) intensive relative to domestic production. This follows from the fact that equation (11) implies that with $U/U' > V/V'$, $U_t/V_t \gtrless U/V$ if U_t, $V_t \gtrless 0$, and vice-versa.

(ii) A country which exports (imports) resources U and V will be revealed abundant in U relative to V if trade is U–(V–) intensive relative to domestic consumption. This follows from the fact that $U/V > U_c/V_c$ implies $U_c/V_c \lessgtr U_t/V_t$ if U_t, $V_t \gtrless 0$, and vice-versa.

More generally, we would expect $U_t/V_t > U/V > U_c/V_c$ in the case of a relatively U-abundant country when both U and V are exported, but $U/V > U_c/V_c > U_t/V_t$ for a U-abundant country when both U and V are imported, and vice-versa.

(B) A second approach uses trade data to compute the hypothetical balanced trade values of net commodity exports for each commodity. From equation (8),

$$y_j^* - c_j^* = y_j - (Y/C)\, c_j, \tag{13}$$

so that it becomes possible to identify the balanced trade export and import bundles and with the help of input-output coefficients to compare the input ratios of these hypothetical bundles for any two factors. However, unless the two resources would flow in opposite directions under balanced trade, the factor intensity ranking of the hypothetical export and import bundles may not reflect the country's relative factor abundance. The required computations are also likely to be cumbersome but this approach has the advantage of explicitly revealing how the trade imbalance has affected the pattern of commodity trade and the factor intensity ranking of exports and imports.

(C) The third approach involves the computation of the hypothetical values of indirect net resource flows under balanced trade. In particular, since $I_t^* = \sum_{j=1}^{m} a_{Ij}\,(y_j^* - c_j^*)$, and $c_j^* = (Y/C)\, c_j$, the share of factor I that would be exported under balanced trade is given by

$$\begin{aligned} I_t^*/I &= 1 - (Y/C)\,(I_c/I) = (Y/C)\,[(I_t/I) - (T/Y)] \\ &= (I_t/I)\,[1 - (I_c/I_t)\,(T/C)], \end{aligned} \tag{14}$$

where $T = Y - C$. It follows that net exports of factor I would be positive

under balanced trade, and the country would be revealed abundant in that factor, if and only if

(i) the ratio of domestic consumption to endowment of factor I is smaller than the ratio of domestic expenditure to output, i.e., $I_c/I < C/Y$; or

(ii) the share of the domestic endowment of factor I which is exported (imported) exceeds (falls short of) the ratio of trade surplus (deficit) to domestic output, i.e., $I_t/I > T/Y$; or

(iii) the ratio of net exports (imports) to domestic consumption of factor I is larger (smaller) than the ratio of the trade surplus (deficit) to domestic consumption, i.e., $I_t/I_c > T/C$.

Conversely, net exports of factor I would be negative under balanced trade and the country would be revealed scarce in that factor if $I_c/I > C/Y$, or $I_t/I < T/Y$, or $I_t/I_c < T/C$. While these criteria are equivalent to Leamer's (1980) hypothesis when limited to *pairwise* comparison of abundance in terms of any two factors [18], they have the additional advantage of revealing the hypothetical balanced trade pattern of factoral flows. Such information is useful in that it would indicate whether a trade imbalance has reversed the sign of the net exports of any given resource, and may in such a case provide an explanation of a Leontief-type paradox.

V. *A Re-examination of Leontief's Data*

In his 1953 article, Leontief computed the amounts of capital and labor the services of which were embodied in U.S. exports and import replacements, and found that $2,550,780 and 182.313 man-years were used per million dollars of exports while $3,091,339 and 170.004 man-years were used for million dollars of import substitutes. This implied that the average capital-labor ratio of U.S. import replacements ($18,184 per man-year) was approximately 30 percent higher than the average capital-labor ratio for its exports ($13,991). Using the export ($16,678.4 million) and import ($6,175.7 million) figures for 1947 also showed that the U.S. had been a net exporter of both capital ($23,452 million) and labor (1,990,795 man-years), so that no inference could be drawn regarding the capital or labor abundance of the U.S. vis-a-vis its trading partners from the ranking of the capital and labor ratios of the export and import replacement bundles [19].

[18] Abundance in factor U relative to V would be tested by comparing U_t/U and V_t/V, or U_t/U_c and V_t/V_c, or U_c/U and V_c/V.

[19] In a subsequent article (1956), Leontief used adjusted figures for the capital – and labor –

Using the data for the U.S. capital stock ($328,519.9 million) and labor supply (47,273,526 man-years) provided by Travis (1964), Leamer (1980) concluded that Leontief's figures had in fact revealed the U.S. abundance in capital, relative to labor, since U.S. trade was more capital intensive than domestic production, which in turn was more capital intensive than domestic consumption. The capital-labor ratios were $11,783 per man-year for net exports, $6,949 for production and $6,737 for consumption. The same conclusion would be reached by observing that the share of the U.S. capital stock exported (0.0714) exceeded the share of labor exported (0.0424).

While Leamer (1980) thus conclusively demonstrated that the U.S. was abundant in capital relative to labor, Brecher and Choudhri (1982) have recently conjectured that since labor requirements had been higher for exports than for imports, the U.S. would have presumably been a net exporter of labor services even under balanced trade. In that case a modified version of the Leontief Paradox would persist since the U.S. would then be revealed relatively labor abundant using the Williams' (1970) definition. Further more, the possibility would remain that the capital-labor ratio of the hypothetical balanced trade import replacement bundle would have exceeded that of the export bundle.

In view of Leamer's (1980) evidence of the U.S. capital abundance relative to labor, and the possibility of continued Leontief Paradox as suggested by Brecher and Choudhri, two important questions remain to be investigated. Firstly, did Leontief's data reveal that the U.S. was *globally* capital abundant in the sense that the U.S. was also capital abundant relative to natural resources? Empirical evidence that this was indeed the case was supplied by Williams (1970) who used data provided by Vanek (1963) to show that the U.S. had also been a net exporter of natural resources in 1947 [20], but that the share of natural resources exported by the U.S. (0.0355) was smaller than the shares of capital and labor exported. To-

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output coefficients. On the basis of these figures, each million dollar of U.S. exports required the use of $2,084,600 of capital and 179.24 man-years, while each million dollars of import replacements required $2,243,900 of capital and 164.28 man-years. Import replacements were still capital intensive relative to exports (though by 17.5 percent only) and both factors were indirectly exported.

[20] Vanek found that the U.S. used $340,000 of natural resources per million dollar of exports and $630,000 per million dollars of import replacements. This implies that the natural resources to capital ratio and the natural resources to labor ratio of U.S. import replacements exceed the corresponding ratios of U.S. exports and suggests – but does not prove – scarcity of natural resources. Vanek's figures also indicate that net exports of natural resources amounted to $2,095 million.

gether with Leamer's result, this demonstrates that the U.S. was globally abundant in capital *and* globally scarce in natural resources.

Since the U.S. actually exported all three factors in 1947, and since the trade data revealed its global abundance in capital and scarcity in natural resources, we may conclude that had trade been balanced, the U.S. would have been observed exporting capital and importing natural resources. The balanced trade net flow of labor services, however, is *a priori* indeterminate. It is necessary to ascertain the sign of this flow to resolve the version of the Leontief Paradox suggested by Brecher and Choudhri.

Using the value for 1947 U.S. national income at current prices provided by Woytinsky and Woytinsky (1953) of $198,688 million [21], the ratio of the trade surplus to domestic output is found to be approximately 0.0529. Since the share of capital exported by the U.S. exceeded, while the share of labor and natural resources exported fell short of this ratio, we may conclude that under balanced trade conditions the U.S. would have been a net exporter of capital, and a net importer of labor (and natural resources) [22]. This contradicts Brecher and Choudhri's conjecture that the U.S. would have exported labor services had trade been balanced. It also follows that the average capital-labor ratio of the U.S. exports would have been found to *exceed* that of its import under balanced trade [23], so that a strong presumption exists that the paradox encountered by Leontief is attributable to the surplus in the American 1947 balance of trade.

VI. *Summary and Conclusions*

In this paper we have examined the implications of trade imbalances on the composition of commodity and indirect factor trade. Since a trade surplus of a country is offset by the deficit in the rest of the world, a trade imbalance has no effect on world demand for commodities or their prices

[21] An alternative method for obtaining an estimate of the 1947 U.S. output is to use the domestic expenditure flows in Table 4 of EVANS and HOFFENBERG (1952) together with the net commodity trade flows computed from Table 2 of LEONTIEF (1953). The figure thus obtained ($194,866 million) yields the same results as those based on the WOYTINSKY and WOYTINSKY (1953) figure.

[22] Specifically, the U.S. would have exported $6,426 million of capital (versus actual exports of $23,452 million) and imported 536,453 man-years and $1,082 million of natural resources (versus actual exports of 1,990,795 man-years and $2,095 million, respectively).

[23] A simulation carried out by the authors using the EVANS-HOFFENBERG (1952) and LEONTIEF (1953) data shows that U.S. net exports would have been approximately 10 percent more capital intensive than import replacements on the average.

given internationally identical and homothetic preferences. It would have no effect on the domestic allocation of resources but would change the amounts of factors embodied in the domestically consumed commodity bundle. Specifically, the amounts of factors embodied in consumption would decrease or increase equiproportionately as the country incurs a trade surplus or deficit. Such a trade imbalance-induced change in factor consumption would necessarily alter the volume of indirect factor trade and may even cause a reversal in the pattern of factor trade. Thus a surplus country may export the services of its scarce factors which would have been imported under balanced trade, and conversely a deficit country may import the services of its abundant factors which would have been exported when trade is balanced.

The hypothetical values of indirect resource flows under balanced trade can be inferred from the actual trade data in order to determine a country's relative factor abundance relative to its trading partners. For example, we have shown that the ratio of net exports (imports) to domestic endowment for each of a country's abundant factor which would be exported under balanced trade must be larger (smaller) than the ratio of that country's trade surplus (deficit) to domestic output.

An important implication of our analysis is that Leontief's method of ranking the capital-labor ratios for U.S. 1947 exports and imports cannot be relied upon to reveal its factor abundance relative to the rest of the world, particularly when the U.S. had such a large trade surplus that it exported the services of all three factors, including natural resources. Since the share of the U.S. capital stock exported (7.1%) exceeded the ratio of its trade surplus to domestic output (5.3%), while the shares of U.S. labor (4.2%) and natural resources (3.6%) exported fell short of that ratio, we conclude that had trade been balanced in 1947 the U.S. would have been observed indirectly exporting capital and importing labor and natural resources. Such a trade pattern of factors would have confirmed unambiguously the American capital abundance and scarcity in labor and natural resources. A strong presumption thus exists that Leontief would not have observed his paradox had U.S. trade been balanced in 1947.

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DISEQUILIBRIO COMMERCIALE, TEORIA DELLE PROPORZIONI TRA I FATTORI E CONTENUTO DI RISORSE DEL COMMERCIO INTERNAZIONALE

Questo lavoro riprende tematiche connesse al cosiddetto 'paradosso di Leontief' e mostra come il disequilibrio commerciale possa distorcere la struttura dell'interscambio di merci e possa causare un'inversione del commercio indiretto di fattori, sicché né l'ordine di intensità dei fattori dei panieri importati ed esportati né il segno dei flussi netti di risorse possono essere indicatori decisivi nell'indicare lo stato di abbondanza relativa dei fattori in un certo paese. Utilizzando il rapporto tra eccedenza o disavanzo commerciale rispetto al reddito quale indicatore, il lavoro dimostra che gli Stati Uniti avrebbero esportato capitale e importato lavoro se l'interscambio commerciale fosse risultato in pareggio nel 1947, sicché il paradosso di Leontief va attribuito all'eccedenza commerciale del paese nel 1947.

Il tema è dunque quello delle conseguenze dei disequilibri commerciali sulla composizione dell'interscambio di merci e sull'interscambio indiretto di fattori. Poiché all'eccedenza commerciale di un paese fa riscontro il disavanzo del resto del mondo, il disequilibrio commerciale non reca alcun effetto sulla domanda mondiale di merci o sui loro prezzi, date preferenze internazionali identiche ed omotetiche. Esso non ha effetto sulla allocazione delle risorse all'interno, ma muta l'ammontare di fattori incorporato nel paniere dei consumi interni. In particolare, gli ammontari di fattori incorporati nel consumo diminuiscono e aumentano equiproporzionalmente a seconda che il paese vada incontro a un'eccedenza oppure a un disavanzo commerciale. Un simile mutamento del consumo dei fattori indotto dallo squilibrio commerciale altera necessariamente il volume dell'inter-

scambio indiretto di fattori e può anche determinare un rovesciamento nella struttura dell'interscambio di fattori. In tal modo un paese eccedentario può esportare i servizi dei suoi fattori scarsi che sarebbero stati importati in condizioni di interscambio in pareggio e viceversa un paese in disavanzo può importare i servizi dei suoi fattori sovrabbondanti che sarebbero stati esportati in condizioni di interscambio bilanciato.

I valori controfattuali dei flussi indiretti di risorse che corrispondono alla situazione di pareggio nell'interscambio possono essere inferiti dai dati dell'interscambio effettivo, al fine di determinare la situazione effettiva di abbondanza relativa dei fattori in un paese al confronto delle sue controparti commerciali. Implicanza significativa dell'analisi in discorso è la critica del metodo di Leontief nell'ordinare i rapporti capitale-lavoro per gli Stati Uniti nel '47 relativamente ai flussi d'interscambio: il metodo di Leontief non può fornire risultati affidabili in senso relativo, in particolare allorché gli Stati Uniti presentavano un ampio avanzo commerciale. Poiché la quota del capitale esportato (7,1%) superava il rapporto tra avanzo commerciale e reddito interno (5,3%), mentre l'opposto accadeva della quota del lavoro e delle risorse naturali, gli autori traggono la conclusione che, qualora l'interscambio fosse stato in pareggio, ne sarebbe risultata una esportazione indiretta di capitale e una importazione di lavoro e risorse naturali nel caso degli Stati Uniti.

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LA NOTION DE RARETE FACTORIELLE DANS LA THÉORIE DU COMMERCE INTERNATIONAL

par
YVES FLUCKIGER *

La notion de rareté factorielle a reçu, dans la théorie pure du commerce international, deux définitions (celles de Léontief et de Ohlin) qui ont été adoptées universellement sans pour autant que les relations entre ces deux approches ne soient toujours clairement précisées. Le but de cet article sera donc d'éclaircir les liens implicites unissant ces deux définitions de la rareté factorielle, ce qui nous permettra de déterminer, d'une part, si elles sont parfaitement équivalentes, et, d'autre part, quelles conditions économiques garantissent leur similitude ou leur dissemblance.

1. *La notion de rareté factorielle*

Le concept de rareté factorielle a été défini de manière différente par Léontief (1956) et Ohlin (1933). Le premier définit la rareté factorielle en se basant sur le rapport des quantités physiques de facteurs de production détenus par les pays considérés. De ce point de vue, le pays A est réputé riche en travail, par rapport au pays B, si:

$$\left(\frac{K}{L}\right) B > \left(\frac{K}{L}\right) A \qquad (1)$$

Au contraire de Léontief, Ohlin fonde sa définition de la rareté sur le

* Université de Genève, Département d'Economie Politique, Genève (Switzerland).

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rapport des prix des facteurs de production régnant dans chacune des deux économies considérées, le pays A étant réputé pauvre en capital si:

$$\left(\frac{w}{r}\right) B > \left(\frac{w}{r}\right) A \qquad (2)$$

où w symbolise la rémunération du facteur de production travail et r symbolise la rémunération du facteur de production capital.

En effet, dans l'approche de Ohlin, le pays qui possède du travail en abondance (A en l'occurrence) sera caractérisé par un prix relatif plus faible de ce facteur de production relativement à l'économie B.

Néanmoins si l'on considère ces deux approches sur le plan purement théorique, la définition de Léontief apparaît beaucoup plus rigoureuse car elle remonte aux sources mêmes de la rareté, à savoir les quantités physiques des facteurs de production détenus par les pays considérés. La définition de Ohlin, en revanche, s'attache à une conséquence économique de la rareté physique des facteurs, laquelle se traduit, dans des conditions économiques spécifiques, par une cherté relative du facteur rare. Cependant, pour obtenir cette relation univoque entre rareté physique et prix des facteurs, il est nécessaire d'introduire implicitement la demande. En d'autres termes, la définition de Ohlin repose à la fois sur les conditions de l'offre et de la demande, alors que l'approche par les quantités est basée uniquement sur les conditions régnant du côté de la production. Ainsi, il n'est pas impossible d'imaginer que, si les consommateurs d'un pays présentent un attrait marqué pour le bien qui utilise relativement intensément le facteur abondant (au sens physique) dans leur économie, ce facteur abondant soit malgré tout relativament cher en comparaison de son prix dans le pays partenaire.

De surcroît, le rapport des rémunérations factorielles est une variable endogène du modèle qui est susceptible, en conséquence, de se modifier sous l'influence de toutes les variables exogènes, ce qui rend la définition de Ohlin tributaire de ces dernières, contrairement à l'approche de Léontief.

En revanche, sur le plan empirique, la définition de Ohlin se prête plus facilement à une mesure statistique puisqu'elle est basée sur des concepts plus aisément quantifiables contrairement à l'approche de Léontief qui présuppose une mesure des quantités physiques des facteurs de production, ce qui, du côté du capital essentiellement, s'avère être une véritable gageure.

Nous sommes donc en présence de deux approches conceptuelles, l'une étant plus rigoureuse sur le plan théorique (celle de Léontief) l'autre se prêtant mieux à une analyse empirique (celle de Ohlin). Dans ces conditions, il devient important de chercher à spécifier clairement les liens qui

unissent ces deux définitions pour déterminer si elles sont équivalentes et dans quelles conditions elles peuvent l'être.

2. *Lien entre la rareté factorielle au sens de Léontief et de Ohlin*

Dans cette deuxième section, nous allons nous efforcer de déterminer la relation économique que l'on peut tisser entre les deux définitions de la rareté factorielle évoquées à la section 1, et ceci en essayant de nous abstraire des hypothèses très restrictives qui ont été adoptées pour justifier la parfaite équivalence entre les deux approches présentées [1]. Pour mener à bien cette discussion, nous nous contenterons de postuler que les fonctions de production utilisées dans les deux pays considérés sont homogènes de degré 1, ce qui constitue en soi l'originalité de notre approche basée sur les conditions économiques les plus générales possibles.

Pour établir aisément ces liens, il nous suffira de préciser la part de la rémunération du capital dans l'économie k (part désignée f_k) dans le produit national, sachant que les deux pays sont caractérisés par des rendements d'échelle constants:

$$f_k = \frac{r_k K_k}{p_{xk} X_k + p_{yk} Y_k} \tag{3}$$

où p_{xk} = prix du bien X dans le pays k
X_k = quantité produite du bien X dans le pays k
Y_k = quantité produite du bien Y dans le pays k
p_{yk} = prix du bien Y dans le pays k

En effet, à partir de cette expression f_k, nous pouvons exprimer le lien entre $(w/r)_k$ et $(K/L)_k$ de la manière suivante:

$$w_k L_k = R - r_k K_k \tag{4}$$

et

$$\frac{w_k L_k}{r_k K_k} = \frac{R}{r_k K_k} - 1$$

[1] Pour certifier l'équivalence des deux définitions, il faut supposer que les deux pays sont caractérisés par des goûts et des fonctions de production parfaitement identiques, ainsi que l'absence de renversement des intensités factorielles.

donc $$\left(\frac{w}{r}\right)_k = \left(\frac{R}{r_k K_k} - 1\right)\left(\frac{K}{L}\right)_k$$

et finalement $$\left(\frac{w}{r}\right)_k = \left(\frac{1}{f_k} - 1\right)\left(\frac{K}{L}\right)_k \qquad (5)$$

En partant de cette relation très simple, transcrite à l'équation 5, nous pouvons émettre dès lors les conditions d'équivalence ou de divergence des définitions proposées par Ohlin et par Léontief, et ceci dans un cadre théorique où nous avons réussi à nous libérer des hypothèses trop restrictives imposées généralement sur les fonctions de production et les préférences supposées identiques entre les deux pays. Ces conditions peuvent se résumer en trois propositions qui forment un théorème original:

1. Si $f_A = f_B$, la relation est dépourvue d'ambiguïté; les deux approches sont parfaitement équivalentes. En d'autres termes, si la part du revenu des capitalistes est la même dans les pays considérés, les deux définitions de la rareté factorielle conduisent exactement au même résultat, quelles que soient les caractéristiques postulées au niveau de le demande et même si les fonctions de production utilisées ne sont pas strictement identiques, mais seulement homogènes de degré 1.

2. En revanche, si les parts des revenus factoriels dans le produit national divergent, nous ne pouvons plus observer cette relation univoque entre les deux approches comme la première proposition nous a permis de le montrer.

Si l'on suppose, par exemple, que $f_A < f_B$, nous serons en présence de deux situations diamétralement opposées que nous allons traiter successivement:

i. Nous commencerons par discuter, tout d'abord, de l'abondance en capital du pays A relativement à l'économie B. Dans ce premier cas d'espèce, nous pouvons montrer aisément que la rareté au sens de Léontief implique nécessairement la rareté factorielle définie par Ohlin. En effet, sachant que $\left(\frac{K}{L}\right)_A > \left(\frac{K}{L}\right)_B$, nous pouvons en déduire:

$$\left(\frac{w}{r}\right)_A = \left(\frac{1}{f_A} - 1\right)\left(\frac{K}{L}\right)_A > \left(\frac{1}{f_B} - 1\right)\left(\frac{K}{L}\right)_A >$$

$$> \left(\frac{1}{f_B} - 1\right)\left(\frac{K}{L}\right)_B = \left(\frac{w}{r}\right)_B$$

donc

$$\left(\frac{w}{r}\right)_A > \left(\frac{w}{r}\right)_B \tag{6}$$

En revanche, l'abondance en capital du pays A, au sens de Ohlin, ne saurait inférer avec certitude celle établie par le concept de Léontief. En effet, si $(w/r)_A > (w/r)_B$, cette observation ne nous permet pas d'en déduire une rareté physique du travail dans l'économie A, puisque:

$$\left(\frac{K}{L}\right)_A = \left[\frac{1}{\frac{1}{f_A} - 1}\right]\left(\frac{w}{r}\right)_A > \left[\frac{1}{\frac{1}{f_A} - 1}\right]\left(\frac{w}{r}\right)_B \gtreqless$$

$$\gtreqless \left(\frac{1}{\frac{1}{f_B} - 1}\right)\left(\frac{w}{r}\right)_B = \left(\frac{K}{L}\right)_B$$

donc

$$\left(\frac{K}{L}\right)_A \gtreqless \left(\frac{K}{L}\right)_B \tag{7}$$

On constate donc qu'il n'est plus possible dans ce deuxième exemple de mettre en exergue une relation claire d'implication entre le concept d'Ohlin et celui de Léontief.

Nous pouvons donc conclure de cette première analyse que si les capitalistes du pays A obtiennent une part plus restreinte du revenu national comparativement au pays B, et que, dans le même temps on constate que ce facteur de production est rare, en quantité, il en découle nécessairement que son prix en A est inférieur à sa rémunération en B.

En revanche, si nous observons un prix relatif du capital plus faible dans le pays A par rapport à B, cela ne nous autorise pas à affirmer que le capital est un facteur abondant (au sens de Léontief); on pourrait, en effet, fort bien imaginer que, malgré sa faible rémunération, le capital soit relativement rare en quantités dans le pays A, ce qui ne contribue qu'à réduire encore sa part dans le revenu national. Dans ce cas particulier néanmoins les définitions de Ohlin et de Léontief son incompatibles.

ii. Dans le deuxième cas, nous envisagerons une abondance relati-

ve de l'économie A en travail. Dans cette situation, les relations d'implications sont exactement inversées par rapport à la première proposition établie précédemment. En effet, nous pouvons montrer par le même procédé que la rareté en capital au sens de Ohlin induit cette fois la rareté au sens de Léontief, la réciproque n'étant pas forcément vraie. En effet, si l'on observe que $(w/r)_A < (w/r)_B$, ce qui signifie que le pays A est pauvre en capital au sens de Ohlin, nous pouvons nécessairement en déduire que:

$$\left(\frac{K}{L}\right)_a = \left(\frac{1}{\frac{1}{f_A} - 1}\right)\left(\frac{w}{r}\right)_A < \left(\frac{1}{\frac{1}{f_A} - 1}\right)\left(\frac{w}{r}\right)_B <$$

$$< \left(\frac{1}{\frac{1}{f_B} - 1}\right)\left(\frac{w}{r}\right)_B = \left(\frac{K}{L}\right)_B$$

en conséquence

$$\left(\frac{K}{L}\right)_A < \left(\frac{K}{L}\right)_B \tag{8}$$

Au contraire, on peut démontrer sans difficulté que la rareté au sens de Léontief n'implique pas nécessairement, dans cette situation particulière, la rareté au sens de Ohlin [2].

3. Finalement, si l'on observe, à l'opposé de la deuxième proposition discutée précédemment, que la part distributive du capital au sein de l'économie A s'avère supérieure à la participation du capital dans le revenu total du pays B, l'ordre des implications est inversé en regard de la proposition 2:

i. la rareté du travail définie par Ohlin implique la rareté au sens de Léontief, la réciproque n'étant pas forcément vraie.

ii. la rareté du capital au sens de Léontief implique celle de Ohlin, la réciproque n'étant pas forcément vraie.

Nous illustrerons ces cas uniquement pour la première partie de la proposition 3.*i* en considérant cette fois que $f_A > f_B$. Sachant que $(w/r)_A > (w/r)_B$ (l'économie A est pauvre en travail au sens de Ohlin), cela nous permet d'en déduire la rareté au sens de Léontief:

[2] La démonstration étant en tous points analogue à celle menée à l'équation (7) nous éluderons ce développement fastidieux.

$$\left(\frac{K}{L}\right)_A = \left(\frac{1}{\frac{1}{f_A} - 1}\right)\left(\frac{w}{r}\right)_A > \left(\frac{1}{\frac{1}{f_A} - 1}\right)\left(\frac{w}{r}\right)_B >$$

$$> \left(\frac{1}{\frac{1}{f_B} - 1}\right)\left(\frac{w}{r}\right)_B = \left(\frac{K}{L}\right)_B$$

donc

$$\left(\frac{K}{L}\right)_A > \left(\frac{K}{L}\right)_B \tag{9}$$

Pour résumer ces différents cas que nous avons illustrés, nous pouvons présenter un tableau synoptique qui permettra de saisir plus facilement le sens des implications entre les deux approches de la rareté factorielle que nous avons évoquées [3]:

	$f_A < f_B$	$f_A > f_B$
A abondant en L	$0 \Rightarrow L$ I	$L \Rightarrow 0$ II
A abondant en K	$L \Rightarrow 0$ III	$0 \Rightarrow L$ IV

3. *Conclusions*

Ces quelques développements nous permettent d'aboutir à un certain nombre de conclusions importantes que nous pouvons synthétiser en quelques points particulièrement marquants:

1. L'approche de la rareté factorielle proposée par Léontief constitue incontestablement l'approche conceptuelle de la rareté la plus convaincante puisqu'elle repose sur une définition basée sur des quantités physiques

[3] Pour alléger ce tableau, nous ne mentionnons que les implications certaines entre les deux définitions de la rareté factorielle.

de travail et de capital détenues par les deux économies. En revanche, le concept d'Ohlin est basé sur une conséquence économique de la rareté factorielle et, de ce point de vue, il est incontestablement moins précis puisque attaché à une conséquence économique d'un état de fait.

2. En revanche, lorsque l'on aborde une analyse empirique, l'approche de Ohlin est sans conteste beaucoup plus aisément applicable, basée qu'elle est sur des concepts facilement quantifiables, contrairement aux mesures des quantités physiques des facteurs de production.

3. Compte tenu de ces divergences constatées entre le concept d'Ohlin et de Léontief, il était important de chercher à définir, dans un cadre théorique le plus général possible, les liens économiques précis unissant ces deux définitions afin de mettre en exergue les conditions de leur équivalence ou, au contraire, de leur divergence quant à la notion de rareté factorielle.

Sur ce point particulier, nous avons apporté un éclairage nouveau puisque nous avons établi que ces deux concepts n'étaient équivalents que si la part distributive de chaque facteur (part aisément mesurable au niveau statistique) était parfaitement identique dans les pays concernés. C'est à cette seule condition que l'on peut effectivement postuler l'équivalence entre l'approche de Léontief et celle de Ohlin, pour autant que l'on s'abstraie des hypothèses très restrictives imposées le plus souvent sur la demande essentiellement.

4. En revanche, dès que ces parts distributives diffèrent, on ne peut plus établir de relations dépourvues d'ambiguïtés entre ces deux approches, comme le tableau synoptique que nous avons construit nous permet de le constater.

En l'occurrence, si l'on discute de l'abondance d'une économie en un facteur de production quelconque, mais, dans le même temps, on observe que ce facteur obtient une part de revenu national inférieure à celle de l'autre pays (cadrans II et III du tableau synoptique), dans ce cas l'approche de Léontief implique la rareté au sens de Ohlin. Ce constat est facilement interprétable économiquement car si un pays détient une quantité importante d'un facteur qui ne reçoit pourtant qu'une infime partie du revenu national, cela signifie nécessairement que sa rémunération est relativement faible.

Au contraire, lorsque l'on débat de l'abondance d'un facteur qui détient une part importante du produit total relativement à l'économie partenaire (cadrans I et IV du tableau synoptique), la définition de Ohlin induit alors celle de Léontief. En effet, si un facteur obtient une rémunération relativement faible et, malgré cela, il reçoit une part importante du revenu national, cela signifie nécessairement que la quantité physique de ce facteur dans le pays considéré est très importante. En revanche, le fait qu'un facteur abondant perçoive une part considérable du produit total n'implique pas nécessai-

rement que sa rémunération soit relativement faible par rapport à l'autre facteur.

5. Finalement, cette analyse nous permet de mettre en évidence la démarche qu'il faudrait s'efforcer de suivre pour mener une étude empirique de la rareté factorielle. Dans un premier temps, il s'agit d'établir clairement la part distributive du facteur capital (par exemple) dans chacune des économies considérées; par la suite, après avoir établi le rapport des prix des facteurs régnant dans chaque pays en état d'autarcie, on peut déterminer si la rareté mise en exergue par la définition d'Ohlin correspond bien à une pauvreté physique de ce facteur qui constitue l'approche la plus adéquate, au niveau théorique du concept de rareté.

En l'occurrence, si la part distributive d'un facteur est plus faible dans un pays donné, seule la rareté relative, au sens d'Ohlin, établie pour l'autre facteur de production (cadrans I et IV), permet d'assurer que la définition de Léontief soit respectée.

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THE NOTION OF FACTORIAL SCARCITY IN THE PURE THEORY OF INTERNATIONAL TRADE

The aim of this paper is to determine the relation between Leontief's and Ohlin's definitions of factorial scarcity. The first part of this note establishes a new mathematical relationship between these two approaches using a very general framework.

The second part is devoted to the determination of the economic conditions which would ensure the equivalence of these definitions. In particular, it is shown that, if the capital's share of national income is identical in all the countries, Leontief's definition will be perfectly equivalent to Ohlin's definition. In all other cases, the two definitions can lead to contradictory conclusions.

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BUSINESS TAXATION AND INDUSTRIAL LOCATION

by
HONG HWANG * and CHAO-CHENG MAI **

Abstract

The purpose of this paper is to construct a theoretical model to examine the effects on a monopolist's optimum location of a corporate income tax and an ad valorem *sales tax. It will be shown that a corporate income tax has no effect on the optimum location, but an* ad valorem *sales tax does have and the extent and direction of this kind of tax effects depend upon the characteritics of the production function in question.*

1. *Introduction*

Beginning with Weber's (1929) seminal work, most of the theoretical studies had paid very little attention to the issue of how taxes affect industrial location [1]. Nevertheless there were many empirical studies using either econometric or survey methods to examine this issue. Most of them found no significant relationship between taxation and industrial location. Early studies of this kind were summarized by Due (1961). More recently, Grieson et al. (1977) considered the impact of business taxes on manufacturing and

* Department of Economics, National Taiwan University, Taipei, Taiwan.
** Institute of the Three Principles of the People, Academia Sinica, Nankang, Taipei, Taiwan.

[1] These studies include those of MOSES (1958), SAKASHITA (1967, 1980), BRADFIELD (1971), EMERSON (1973), WOODWARD (1973), KHALILI, MATHUR and BODENHORN (1974), MILLER and JENSEN (1978), MATHUR (1979, 1983), MAI (1981, 1984), ESWARAN, KANEMOTO and RYAN (1981), MARTINICH and HURTER (1982), and HSU and MAI (1984). However, the exception may be the work of FOX (1978) and WOODWARD (1974).

nonmanufacturing firms in the New York City region, and found that manufacturing firms were sensitive to local tax rates, while nonmanufacturing firms were not. So far, the debate over the effect of business taxation on industrial location still continues. It seems that one important step toward a solution to this problem is a detailed theoretical exploration of the locational effect of taxation.

The purpose of this paper is to construct a theoretical model to examine the effects on industrial location of a corporate income tax as well as an *ad valorem* sales tax. It will be shown that a corporate income tax has no effect on industrial location, but an *ad valorem* sales tax *does* have and the extent and direction of this kind of tax effects depend upon the characteristics of the production function in question.

The remainder of the paper is divided into three sections. In the first, a simple location model without taxation is briefly reviewed. In the second, we investigate the effects on industrial location and input usage of a corporate income tax and an *ad valorem* sales tax. In the final section, we summarize some conclusions and provide some policy implications.

2. *A Basic Model*

Assume that the location of a monopolist is limited to a set of points along a linear line of length as depicted in Figure 1. In this figure, I is the market site where the output of the firms is sold; J is the site where the input M comes; x is the distance between the market and the monopolist's location K.

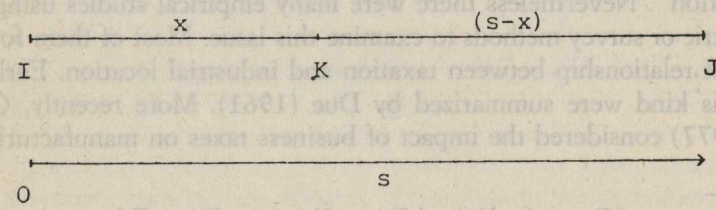

FIGURE 1. Location in Linear Space

Next, for simplicity, it is also assumed that the firm uses raw material M as input to produce his output Q. The firm's production function is specified as follows:

$$(1) \qquad Q = f(M) \text{ with } f_M \equiv \frac{\partial f}{\partial M} > 0 \text{ and } f_{MM} \equiv \frac{\partial^2 f}{\partial M^2} < 0$$

where the subscripts denote derivatives.

Furthermore, the demand function for the firm's product at the market site is given by:

$$(2) \qquad P = P(Q) \text{ with } P_Q \equiv \frac{\partial P}{\partial Q} < 0$$

Under these conditions, the firm's profit function with no tax is:

$$(3) \qquad \pi^* = [P(Q) - h(x)\, x]\, f(M) - [m + r(x)\,(s - x)]\, M$$
$$= [P(Q) - u(x)]\, f(M) - [m + v(x)]\, M$$

where π^* is the before-tax profit of the monopolist; $h(x)$ and $r(x)$ are the transport rates of Q and M respectively; $u(x) \equiv h(x) \cdot x$; $v(x) \equiv r(x) \cdot (s - x)$; m is the price of input at the input site.

The first-order conditions for profit maximization are given by:

$$(4) \qquad \frac{\partial \pi^*}{\partial x} = \pi^*_x = -u_x f(M) - v_x M = 0$$

$$(5) \qquad \frac{\partial \pi^*}{\partial M} = \pi^*_M = [MR(Q) - u(x)]\, f_M - [m + v(x)] = 0$$

where $MR(Q) \equiv P + P_Q \cdot Q$ is the marginal revenue of output.

Equation (4) indicates that profit maximization requires marginal transport cost of output with respect to distance (i.e., location) be equal to that of input. Equation (5), on the other hand, states that the monopolist equates the net marginal revenue of product (net of transport cost of output) to the effective factor price (the sum of factor price and trasport cost of input).

So far, we have briefly reviewed the Weber-type of location-production problem as discussed in location literature and are ready to examine the effects of taxation on the firm's location and input usage.

3. *The Effect of Business Taxation on Industrial Location and Input Usage*

In this section, we will consider the following two types of taxes: (*A*) a profit tax (i.e., a corporate income tax) and (*B*) an *ad valorem* sales tax.

(*A*) A profit tax

If a profit tax is imposed, the monopolist is required to pay the government a specified proportion of the difference between his total revenue and total cost. If the tax rate is β $(0 < \beta < 1)$, then the monopolist's after-tax profit is:

$$\pi^A = (1 - \beta)\, \pi^* \tag{6}$$

The first-order conditions for profit maximization require:

$$\frac{\partial \pi^A}{\partial x} = (1 - \beta)\, \pi_x^* = 0 \tag{7}$$

$$\frac{\partial \pi^A}{\partial M} = (1 - \beta)\, \pi_M^* = 0 \tag{8}$$

Since $(1 - \beta > 0$, it follows from equations (7) and (8) that:

$$\pi_x^* = 0 \tag{7'}$$

$$\pi_M^* = 0 \tag{8'}$$

Since the first-order conditions are the same as equations (4) and (5), the optimum location and input usage for the monopolist are unaffected.

(*B*) An *ad valorem* sales tax

Let the rate of an *ad valorem* sales tax be α $(0 < \alpha < 1)$. Then the monopolist's profit function becomes:

$$\begin{aligned} \pi^B &= [P(Q) - u(x)]\, f(M) - [m - v(x)]\, M - \alpha P(Q)\, f(M) \\ &= \pi^* - \alpha P(Q)\, f(M) \end{aligned} \tag{9}$$

Setting the derivatives of (9) with respect to x and M respectively equal to zero obtains:

$$\frac{\partial \pi^B}{\partial x} = \pi_x^B = \pi_x^* = u_x f(M) - v_x M = 0 \tag{10}$$

$$\begin{aligned} \frac{\partial \pi^B}{\partial M} &= \pi_M^B = \pi_M^* - \alpha \cdot MR(Q) \cdot f_M \\ &= [MR(Q) - u(x)] f_M - [m + v(x)] - \alpha \cdot MR(Q) \cdot f_M = 0 \end{aligned} \tag{11}$$

Equation (10) is the same as equation (4), but equation (11) is different from equation (5). Recall that the marginal conditions without the imposition of tax are exactly the same as that with a corporate income tax. In what follows, the location and input usage without the imposition of tax will be compared with that with an *ad valorem* sales tax. At this moment, it is worth noting that if $\alpha = 0$, equations (10) and (11) will be reduced to equations (4) and (5) immediately. To make such a comparison as mentioned above, taking the total differentials of (10) and (11) with respect to x, M and α, then assuming $\alpha = 0$ initially and finally applying Cramer's rule, we obtain:

$$\frac{dx}{d\alpha} = \frac{-1}{D} MR\,(Q)\, f_M \pi_{xM} \tag{12}$$

$$\frac{dM}{d\alpha} = \frac{1}{D} MR\,(Q)\, f_M \pi_{xx} \tag{13}$$

where

$$\pi_{xx} = -u_{xx} \cdot Q - v_{xx} \cdot M$$

$$\pi_{MM} = [(1-\alpha)\, MR\,(Q) - u\,(x)]\, f_{MM} + (1-\alpha)\,[2P_Q + P_{QQ} \cdot Q]\, f_M^2$$

$$\pi_{xM} = -u_x f_M - v_x$$

$$D = \begin{vmatrix} \pi_{xx} & \pi_{xM} \\ \pi_{Mx} & \pi_{MM} \end{vmatrix}$$

Note here that the second-order conditions for this problem require that $D > 0$, $\pi_{MM} < 0$ and $\pi_{xx} < 0$ [2].

Let us first consider equation (13). It immediately follows from (13) that

$$\frac{dM}{d\alpha} < 0 \tag{13'}$$

This shows that the imposition of *ad valorem* sales tax will induce the monopolist to employ less input and hence to produce less output. This result is similar to that in the traditional nonspatial framework.

We now turn to equation (12). It is clear that the sign of $\frac{dx}{d\alpha}$

[2] For detailed discussion on this point, see MAI (1981).

is indeterminate, as it depends upon the sign of π_{xM}, and in turns upon the characteristics of the production function in question. To pursue our argument further, let us assume that the production function is homogeneous of degree n. Then equation (1) becomes:

$$f_M \cdot M \equiv n \cdot Q \tag{14}$$

Via (14), we can evaluate the sign of π_{xM} as follows:

$$\pi_{xM} = \frac{-1}{M} u_x \cdot Q \cdot (n-1) \gtreqless 0 \text{ iff } n \gtreqless 1 \tag{15}$$

Substituting (15) into (12) obtains:

$$\frac{dx}{d\alpha} \lesseqgtr 0 \text{ iff } n \gtreqless 1 \tag{16}$$

Thus, the optimum location for the monopolist is independent of an *ad valorem* sales tax if and only if the production function is constant returns to scale. Furthermore, the imposition of this tax would induce the monopolist to move its optimum location closer to (farther away from) the output market if and only if the production function is decreasing (increasing) returns to scale. The economic interpretation is as follows. As noted above, the imposition of an *ad valorem* sales tax will lead to a decline in the input usage. When the production function exhibits decreasing returns to scale, a corresponding decrease in output will be less than the decrease in the input usage. As a result, the market pull is stronger than the input pull. Therefore, the monopolist will move its location towards the output market site.

3. *Conclusions*

This paper has investigated the effects on a monopolist's location and production decisions of a corporate income (i.e., profit) tax as well as an *ad valorem* sales tax. It has been shown that a corporate income tax reduces the profit of a profit-maximizing monopolist, but does not affect his optimum location and input usage. On the contrary, an *ad valorem* sales tax *does* exert some influence on the optimum location and input usage. Specifically, the imposition of an *ad valorem* tax will necessarily result in a smaller input usage and hence output. In addition, the optimum location of the monopolist is invariant with respect to the imposition of an *ad valorem* sales tax if and only if the production function is homogeneous of degree one.

However, this tax would lead the monopolist to move its optimum location closer to (farther away from) the output market if and only if the production function is decreasing (increasing) returns to scale.

In reality, the significance of tax effect on actual location decisions is difficult to assess; it might depend upon the tax structure and the nature of the production function in question. Of course, the impact of taxation must be analyzed in a more subtle and more comprehensive way. Nevertheless, even our simplified model can cast a light upon the nature of location decision under different types of taxation.

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IMPOSTE SULLE IMPRESE E LOCALIZZAZIONE DELLE ATTIVITÀ

Il lavoro indaga circa gli effetti delle imposte sui profitti e delle imposte *ad valorem* sulle vendite, sopra le decisioni produttive e di localizzazione di un'impresa monopolistica. Si dimostra che un'imposta sul reddito d'impresa riduce il profitto di un monopolista massimizzatore del profitto, ma non influisce sulla localizzazione ottimale e sull'ottima utilizzazione degli input. Al contrario un'imposta *ad valorem* sulle vendite esercita la sua influenza sulla ottimalità di localizzazione e di impiego dei fattori. In particolare l'applicazione di un'imposta *ad valorem* darà luogo necessariamente a minore utilizzazione degli input e quindi minore prodotto. Inoltre la localizzazione ottimale dell'impresa monopolistica è invariante rispetto all'introduzione di un'imposta *ad valorem* sulle vendite se (e solo se) la funzione di produzione è omogenea di primo grado. Tuttavia è possibile concludere che una tale imposta condurrà il monopolista a spostare la località ottimale più vicino (più lontano) al mercato del prodotto se e solo se la funzione di produzione presenta rendimenti decrescenti (crescenti) di scala.

In realtà l'importanza dell'effetto dell'imposta sulla effettiva decisione di localizzazione è difficile da stabilire: potrà dipendere dalla struttura d'imposta e dalla natura della funzione della produzione in questione. Benché si richieda ulteriore analisi, anche un modello molto semplificato (qual è quello che qui si presenta) sembra capace di offrire utili indicazioni sulla natura delle decisioni di localizzazione con diversi regimi fiscali.

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SOVIET AGRICULTURE: THE PROBLEMS AND THEIR CAUSES. PROSPECTS

by
Tassos Fakiolas *

Abstract

The essay deals with the main problems of Soviet farming. An attempt is made to explain the causes why the USSR, being the biggest producer of fertilizers, tractors and other agricultural machines and with the biggest farms in the world, and having at its disposal more specialists in agriculture than any other country, is so far behind the West in labour productivity, while the per capita consumption of food is much lower than the rational norms.

The writer of this essay tries also to explain why the Soviet Union has not any prospects, at least till the end of our century and the beginning of the next, to catch up with the USA and other advanced countries in labour productivity as far as the agricultural sector is concerned.

I. The Problems

The present problems of the Soviet Union in the agricultural sector are mainly the following: a) the low level of labour productivity; b) the inability of the sector to secure enough food for the population, and c) the need to import big quantities of agricultural products, first of all grains.

* Counsellor of the Ministry of National Economy, Athens (Greece). As there are many differences between the Soviet and Western statistics and in order to make the data comparable, they are all taken from Soviet sources. There is only one exception (p. 259), a source of Food and Agriculture Organization (FAO), of the United Nations. The writer's book (Fakiolas, 1982) which is used in the text as a source, is based on Soviet data.

1. *Productivity*

In 1928, when the collectivization began to be implemented (the decision was taken in December 1927) and tens of thousands of kolkhoz were created, it was argued that the collective farm system should display the advantages of large scale production. Concretely, it should make it possible to develop agriculture on a modern industrial basis and achieve the highest productivity in the world.

By the end of the Second Five-Year Plan (1937) the Soviet Union became the country with the largest average agricultural holdings in the world. The number of state and co-operative farms was nearly 4,000 and 242,000 respectively, compared to the 25,000,000 individual holdings in 1927. The average agricultural holding of a kolkhoz was 485 ha against 20 ha in the United States (Podkolzin, 1968, p. 259).

It was hoped that the USSR, having at its disposal such big farms, would play a leading role in the agricultural sector as far as labour productivity was concerned. In fact, the opposite happened. The lag of the Soviet Union behind the advanced countries in the West is especially great in agriculture, where, according to Soviet estimates, the labour productivity in the latter is much higher than in the former. In 1966-1978 and in 1966-1982 if the level of USA was 100, the level of USSR was 20-25 (*The National*, 1983, p. 57; Statistical Service of USSR, 1983, p. 62).

However, the difference in labour productivity is still greater than the one the Soviet data show.

In 1971-1982 and in the last five years, the average agricultural production of the USSR was 85 per cent of that of the USA. The USSR is "far behind" the USA in the output of grain, fruits and especially meat (*Yearbook USSR,* 1983, p. 112). At the same time, the Soviet agriculture employed 24.6 mln persons (1982), (Fedorov, 1983, p. 81), against about 3,5 mln. persons in USA (1975) or 20-25% of the labour force in USSR (in 1970 - 25%, in 1975 - 23%, in 1980 - 1982 - 20%), (Statistical Service of USSR, 1983, pp. 61, 161), compared with 3.5% of the labour force (1975), of USA (Aperyan, 1976, pp. 123, 126). Considering all the above mentioned as well as the fact that the Soviet agriculture does not include fishing, we can conclude that in USA the productivity is not 4-5 but 6 and more times higher than in USSR.

2. *The Food Shortage*

The shortage of foodstuff began soon after the realization of the deci-

sion for massive collectivization. Concretely, from 1928 serious difficulties occurred in the supply of cities with foodstuff, while from 1929 the introduction of coupons for the distribution of bread, sugar and other items became necessary (Gladkov, 1977, T. 3, p. 451). Because of the lack of bread, its price "was increased 4-6 times" (Trifonov, 1975, p. 256).

With the overfulfilment of the First Five-Year Plan in 1932, the situation was not improved. Despite the fact that the system of coupons was in force, there were interruptions in the supply of the city shops with foodstuff (Borisov et al., 1975, p. 291).

As regards the food situation during the war, it is enough to quote the following facts: while the salaries remained at about the same level, the prices of the urban markets surpassed (1943) the pre-war level 13 times (Paspelov, 1960, T. 6, p. 77). In the black market the prices were much higher. For example, one kilogram of potatoes was sold at 45 rubles and a small piece of sugar – at 10 rub. (Erenburg, 1967, vol. 9, pp. 335, 379). Even in the countryside the food problem was acute. In 1942 for example, the kolkhoz gave to each of its members an average of 129 rub., 100 kg grain and 30 kg potatoes for the whole year (Kim, 1974, vol. X, p. 288).

The food shortage and the bad nutrition of the Soviet people continued even after the war (Podkolzin, 1968, p. 312; *Pravda*, 25.2.1976, p. 6; *Kommunist*, 1976, No. 16, p. 13; *Kommunist*, 1979, No. 17, p. 15; *Pravda*, 16.7.1981, p. 1).

In the Report of the Central Committee of the CPSU to the XXVI Congress of the Party (1981) it was recognized that "difficulties in supplying the population with food still exist" and that to solve the problem of securing uninterrupted food supplies to the population it is necessary to work out a special food programme (Brezhnev, 1981, pp. 79-80).

It is worth noting that the administrative bodies of the country are seriously concerned with "the irregular supply of consumer items" (Danilov, 1980, p. 119).

The XXIV Congress of the CPSU (1971) "elaborated a scientific programme of the economic, social and cultural development of the Soviet society" and defined the new Five-Year Economic Plan as "a major increase in living standards" (*The CPSU*, 1980, pp. 68-69). Although "the main object" of all the Five-Year Plans, starting with the very first, has been and continues to be "the improvement of the Soviet people's living standards" (Danilov, 1980, p. 23), till now it has not been possible to secure a satisfactory level of nutrition.

In USSR the average diet is sufficient in terms of caloric content, but not in terms of protein. Concretely, the consumption of potatoes, bread and

TABLE 1

PER CAPITA CONSUMPTION OF BASIC AGRICULTURAL PRODUCTS IN USSR AND RATIONAL NORM (kg)

Products	Rational Consumption Norms	Actual level of consumption in					Plan
		1975	1980	1981	1982	1980-82 (average)	1990
Meat and meat products	82	57	58	57	57	57	70
Milk and dairy products	434	316	314	304	295	304	335
Egg (Pieces)	292	216	239	247	249	245	263
Vegetables and Melons	146	89	97	99	101	99	130
Fruits	113	39	38	40	42	40	68
Potatoes	97	120	109	104	110	108	110
Bread and bread products	120	141	138	137	137	137	135

Sources: MOROZOV, 1977, p. 214; THE NATIONAL, 1983, p. 411; CMEA, SECRETARIAT, 1981-83, p. 55-57, STATISTICAL SERVICE OF USSR, 1983, pp. 42, 187; BOGOLYUBOV, 1983, p. 30.

TABLE 2

IMPORTS IN USSR OF GRAIN, MEAT AND MEAT PRODUCTS IN 1972-1982

Products	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Grain (mln. tons) *	15.5	23.9	7.1	15.9							
Of which wheat	8.1	15.2	2.7	9.1							
Value of grain (mln. rub.)	733	1146	535	1923	2323	1028	1655	2254	3176	4815	4218
Of which wheat	424	749	226	1164	835	670	698	1003	1868	2492	2834
Animals for slaughter (thous. tons) *	70	72	147	260							
Value (mln. rub.)	31	32	85	137	76	86	52	89	99	127	133
Meat and meat products (thous. tons)	131	129	515	515	361	617	183	611	821	980	939
Value (mln. rub.)	80	82	361	356	286	516	177	555	883	1185	1036

* After 1975 data for imports in quantity are not given.
Source: *The External*, 1973-1982.

bread products is far above the rational norms, while the level of consumption of products of animal protein is far below them. "The growth in animal products is still insufficient judging by the per capita consumption standards recommended by Soviet Scientists" (*Yearbook, USSR,* 1984, p. 130). The structure of consumption is worse in vegetable and especially in fruits, where the average level of consumption is nearly 3 times below the rational norm.

The most vivid proof that the Soviet agriculture has been unable to

grow enough to feed the population is the fact that the USSR has been turned into a net importer of food, especially grain and meat from the Western countries.

The imports of cereals and meat increased from 733 and 80 mln. rub. in 1972 to 4,218 and 1,036 mln. rub. in 1982 respectively (*The External*, 1973-82, pp. 11, 91).

In 1981-1982 the average yearly output of grain is estimated at 170 mln. tons (official data are not available), about 60 mln. tons less than the plan provided. The import of grain is estimated at 35-40 mln. tons yearly.

Before the October Revolution and the First World War Russia was an important exporter of grain. Specifically, in 1913 Russia exported more than 9 mln. tons of grain (Genin, 1970, p. 139).

At the XXII Congress (1961) the leader of the CPSU expressed the assurance that the Soviet Union "will conquer such a position in the world market of grain that will oblige imperialists to understand how our agriculture is developing" (*Materials,* 1961, p. 156).

Indeed, the Soviet Union conquered a prominent place in the world market of grain, but not as an exporter as it was expected, but as an importer.

II. The Causes of the Problems

According to Soviet historiography the reasons for the shortage of foodstuffs and the low standard of living of the Soviet people are mainly three: The need for a quick industrialization (Danilov, 1980, pp. 12, 33), the imperialist danger (Tetiusev, 1978, p. 109; Marushkin, 1972, p. 99) and the unfavourable weather conditions (Brezhnev, 1975, p. 21; *Pravda*, 25.2.1976 and 5.3.1981).

With the industrialization of the country and the transformation of the Soviet Union to a superpower, the sole argument for the insufficiency remained the unfavourable weather conditions. In 1981 the leader of the CPSU said: "Long experience shows that bad weather for agriculture occurs to us every two years" (*Kommunist*, 1981, No. 17, p. 5). The years during which Nature has been kind to the Soviet farmer "may be literarily counted on one's fingers" (Morozov, 1977, p. 18).

However, the real causes for the shortage of foodstuff have nothing or very little to do with the unfavourable weather conditions. It suffices to say that only inadequacy in food supply to the population on the way from the farm to the shop "inflicts as much damage on stocks of food and raw

materials as drought or other whims of nature" (*Yearbook USSR*, 1983, p. 114).

If USSR has not solved its food problem, has such a low labour productivity, and has not managed to offer to its people what even the small-scale individual peasant household of the less developed countries of Europe has managed to offer, it is because the laws of economic and social evolution were violated.

The causes of the crisis in the Soviet agriculture are mainly the following: a) The unripeness of the objective conditions for the socialization of the agricultural sector, b) The implementation of forcible methods for the achievement of collectivization, c) The lack of incentives and opportunities to develop creative initiatives.

1. *Unripeness of Objective Conditions*

When the decision for the collectivization was taken (December 1927), the technical basis of the Soviet agriculture was very feeble. Till then, the Soviet Union had produced less than 2400 tractors, while the production of combines had not yet begun. (It began in 1930 with 374 pieces; *The National,* 1956, pp. 75, 77). It is worth mentioning that in 1928 only 0.2-1% of the work for the production of cereals was done by mechanic means (*The National*, 1958, p. 492).

In 1928 the productive capacity of collective farms was very low. There were only 5 heads of cattle per collective farm, 2 pigs and 0.2 tractors. Even by the mid 1930, when collectivization was almost completed and eight-tenths of the land under cultivation were associated with collective farms, there were only 44 heads of cattle per collective farm, 15 pigs and 0.8 tractors, i.e. less than a tractor (Morozov, 1977, p. 66).

As regards the cultural level of the Soviet people, it is enough to say, that in 1926 45% of the urban population (Borisov et al., 1975, p. 187) and of the rural population 43% of men and 66% of women were illiterate (*The CPSU*, 1980, p. 33).

The Soviet leaders did not realize that to run a large farm efficiently involved the existence of many educated persons, who have acquired technical skills and master the art of management and marketing.

Stalin and his followers did not realize that in a massive collectivization it was necessary to solve not only economic, but also moral and psychological problems, that the latter are much more difficult than the former and that, if the building of a collective farm takes several months, to remodel the

way of thinking of tens of millions of farmers, born under the system of private ownership, might take many decades and even centuries.

It has to be reminded that it was only in 1861 that serfdom was abolished in Russia, and that the land was really distributed among the peasants only after the October Revolution, when 150 million hectares were confiscated from owners of large estates and the Tzar's family.

2. *Implementation of Forcible Methods*

The Soviet peasants did not enjoy the land they received without payment in result of the Revolution. Some years later they were obliged to give this land back, together with the land they had before the Revolution (Balatski, Talalayev, 1980, p. 7-64).

That the alienation of Soviet peasantry from the means of production was forcible is evidenced by the following facts:

As it is shown on Table 3, in the period 1929-1933, 780,000 families

TABLE 3

COLLECTIVIZATION OF INDIVIDUAL HOUSEHOLDS, INDEX OF PRODUCTION AND NUMBER OF DEPORTED PEASANT FAMILIES

Years	Collectivization of individual households % of the total	Collectivization of arable land % of the total	Index of agricultural production 1913 = 100	Index of animal production 1913 = 100	Agricultural families deported during collectivization (in thous.)
1928	1.7	2.3	124	137	
1929	3.9	4.9	121	129	330
1930	23.6	33.6	117	100	
1931	52.7	67.8	114	93	370
1932	61.5	77.7	107	75	30
1933	...	...	101	65	50

Source: *The National*, 1956, p. 99 and 1958, pp. 346-347; STATISTICAL SERVICE OF USSR, 1971, p. 33, DANILOV, 1970, p. 239; GLADKOV, 1977, p. 377.

were deported. To this number must be added those who were deported before and after this period, as well as 200,000 families which were selfliquidated. The leaders of these families escaped because they were wanted (Danilov, 1970, p. 239). During collectivization more than one million families with about five million members were deported to the remote regions of the North, the Far East, Siberia and Kazakhstan (Kim, 1974, p. 259; Trifonov, 1975, pp. 343, 371).

The above mentioned official data may not support the assurance that "man is the most precious capital of Soviet society" (Kosolapov, 1983, p. 82). Also, they may not support the validity of the arguments that in the case of peasants was applied "cooperation on a voluntary basis", that "this was the way the socialist property of collective farms appeared" (*Socialism: Theory and Practice,* 1983, p. 61), and that the collectivization of farms was "gradual and voluntary" (Abalkin, 1980b, p. 25), when it is recognized that the "specific features of this revolution (as the collectivization is called - T.F.) was that it was made from 'above', with the initiative of the state authority. Stalin elaborated and fulfilled practically the theory of collectivization" (Alexandrov-Galaktionov, 1950, p. 133).

3. *The Consequences*

The massive and forcible collectivization, before the necessary prerequisites had ripen, had negative repurcussions on the development of agriculture. As Table 3 shows, the level of production fell to the point at which it was 20 years before. Animal production suffered more. Its level fell rapidly and was about two times lower than it was three-four years before the massive collectivization and 1/3 lower than in the prewar time.

The misuse of the means of production in agriculture (machines, fertilizers, building, land, etc.) occurred not only in the period of collectivization. It continued even after the "victory of socialism" in USSR (Fakiolas, 1982, p. 254-258).

It is recognized that "the fertilizers are not protected carefully, they are left in the open air and spoiled by bad weather conditions" (*Pravda*, 15.2.1982, p. 1). At the same time many spare parts are used as scraps, while a lot of tractors are not working because of lack of spare parts (*Pravda* 26.9.1975, p. 1). Because of the lack of machines, the execution of the basic agricultural operations demand double time than the optimal (Kim, 1974, p. 115).

Investigations carried out in many regions of the country showed that "40-70% of tractors and motors are given for general repair having defects, which could be remedied with the change of one or two spare parts" (*Pravda*, 29.11.1973).

It was estimated that in 1977 in Belorussia and Ukrain 7 million working days were lost because of the misuse of agricultural machines (*Voprosi Ekonomiki*, 1979, p. 100).

Some Soviet scientists are especially worried about the uneconomic use

of land. They argue that "land has its price and sometimes value as well, which should be defined by the costs of labour and capital" (Usakova-Factor, 1968, p. 150).

The land resources of USSR account for 14 per cent of the world's agricultural land and 16 per cent of the arable land (*Novoye Vremya* of Moscow, 1983, No. 8, p. 18). The land in use exceeds 604 mln hectares. Of this area, Soviet farmers cultivate 226 mln each year, collect hay on nearly 43 mln, and place about 300 mln under pasture (Morozov, 1977, p. 14).

There are 2,3 ha of farmland per person and every collective (State) farm has on average 537 (557) farm workers, 41 (58) tractors and 6,7 (18,9) thousand ha farmland (Sarkisyants, 1980, p. 123).

No one doubts that large farms are characterized by increased technical facilities, application of chemical and biochemical research, better conditions and opportunities for increasing accumulation, lower per-unit cost of farm products. But for achieving high productivity this is not enough. This is confirmed by the following facts: USSR has more agricultural area and produces more tractors, combines (in terms of total engine capacity), agricultural machines and fertilizers than any Western country (*The National*, 1983, pp. 66, 68; '*New Times*' of Moscow, 1983, No. 8, p. 19) and 1.8 mln. specialists with high education (*Voprosi Istorii CPSU*, 1983, p. 114).

It has to be added that the educational level of workers and peasants in the countryside is very high. The number of collective farmers with secondary and higher education has risen to more than 60 per cent of the total, (*Socialism: Theory and Practice,* 1983, No. 1, p. 58). It is worth mentioning that in the villages are working 6 million members of the party – one third of the whole (*Voprosi Istorii CPSU*, 1983, p. 118).

Despite the above mentioned data, the Soviet farms cannot compete with Western farms, although the former are the biggest in the world and the latter in their overwhelming majority consist of small and medium size households.

The Soviet leaders, instead of encouraging the private initiative and thereafter carefully and patiently restructuring small-scale production through cooperation, from its lower forms (consumer, marketing and credit co-operatives) to its higher form (producer co-operatives), actually do the opposite. In less than a decade they passed all the above mentioned stages, despite the fact that the USSR "lacked experience in restructuring agricultural production and the entire way of life of peasants along new lines" (Abalkin, 1980b, p. 25). Concretely, in 1937, 98.5 per cent of the agricultural production (including income of individual households of Kolkhoz members) was produced by the state and co-operative sectors of the economy,

against 3.3 per cent in 1928 and 1.5 in 1924. The Soviet leaders now try to encourage the private initiative. "The state assists the population in cultivating the personal land plots" (Abalkin, 1980b, p. 38). The CPSU took measures for the development of the subsidiary plots of rural dwellers (Brezhnev, 1981, p. 84).

In 1939 the percentage of individual peasants and craftsmen of the total population fell to 2.6% against 74.9% in 1928 (*The National*, 1978, p. 39 and p. 9). This means that the percentage decreased nearly 29 times. In the same year, the XVIII Congress (1939) stressed that Socialist Society "had been mainly built" in the Soviet Union, while the XXI Congress (1959) stated that socialism "had triumphed fully and decisively" in the USSR (*The CPSU*, 1980, pp. 51, 59).

In fact, the collectivization led to excessive concentration and amalgamation and to creation of uncontrollable farms. At the same time, cooperative farms are engaged in many branches. The result is that the cost of agricultural produce "remains virtually unchanged despite the steady annual increase of capital investment by the state" (*Yearbook USSR,* 1983, p. 115).

The above data show that there is not any rational utilization of public wealth – material, financial resources and most of all, human labour. The forcible alienation of Soviet peasants from their land and tools resulted in their apathy and unwillingness to work and assume responsibility.

III. Prospects

1. *Soviet Forecasts and Reality*

For the last two decades the Soviet leaders avoid to make any forecasts and define how and when the Soviet Union will surpass the Western countries in general and especially in agriculture. The reasons are obvious.

In 1930 the Resolution of the XVI Congress of the CPSU noted that on the basis of collectivization the Party will be able "to begin the fulfillment of the slogan 'to catch up with and outstrip' the capitalist countries not only in industry, but in agriculture too" (Vlasov, 1961, p. 93).

Three decades later, in 1959, the XXI Congress of the party expressed the assurance that in 1970 the USSR "will lead the world in the absolute volume of production, as well as in the per capita production" (*The Extraordinary,* 1959, Vol. 2, p. 446).

The Resolution of the Congress argued that "in the agricultural sector

the main purpose is to reach the adequate level of production for the complete satisfaction of the needs of the population as far as foodstuff is concerned" (*The Extraordinary*, 1959, Vol. 2, p. 436).

The next Congress of the Party (1961) estimated that in two decades the USSR "will surpass the economic level of the most advanced capitalist countries and will achieve the highest standard of living in the world" (*Materials*, 1961, p. 141).

According to the third Programme of the CPSU (1964), in a decade the USSR should surpass the USA "in per capita production of the main agricultural products", while in the second decade there should be "an adundance of goods for the total of the population" which should have the possibility to satisfy its needs "in food of high quality" (*The Programme*, 1964, pp. 78, 93).

TABLE 4.

EXPECTED AND ACTUAL PRODUCTION OF MAIN AGRICULTURAL PRODUCTS IN USSR

Products (in mln. tons)	Expected		Actual (average)		Plan
	1970	1980	1976-1980	1981-1982	1986-1990
Grain.....	229	295-311	205.0	170 *	250-255
Meat.....	25	30-32	14.8	15.3	20-20.5
Vegetables.....	47	55	30.0	28.5	37-39
Fruits.....	28	51	9.4	10.3	14-15

Source: *Materials*, 1961, pp. 144, 153; *Pravda*, 28.2.1981; STATISTICAL SERVICE OF USSR, 1983, pp. 43, 117; CMEA SECRETARIAT, 1981-83, pp. 194-199, 212.

* Estimation of the FAO. Soviet data are not available.

As Table 4 shows, the actual production of main products in 1976-1980 was 0.5-5 times below the targets set for 1980. Specifically in grain 0.5, in meat and vegetables 2 and in fruits 5 times below. It is worth saying that for all of the above mentioned products the targets set for 1970 were far from fulfillment in 1981-1982. They are not expected to be fulfilled (except for grain) even in 1986-1990.

As it was already mentioned, in 1971-82 the Soviet agricultural production was about 85 per cent of the American level (*The National*, 1978, p. 49; Statistical Service of USSR, 1983, p. 61). It is obvious that the target of surpassing the United States was not fulfilled not only in per capita production, but even in volume.

2. *The Prospects in Productivity*

It is estimated that 92 per cent of the entire able-bodied population of the USSR is employed in socialized production and that in the foreseeable future there will be a "sharp drop in the numerical growth of the labour resources as compared with the current decade" (Kosolapov, 1983, p. 62). At the same time, it is foreseen that by 1990 the rural population of the Soviet Union will be the 25-30 per cent of the total (Kosolapov, 1976, p. 129), against 36 per cent in 1982 (Statistical Service of USSR, 1983, p. 7).

From the above it is clear that almost the only way for the increase of agricultural production in USSR is the increase in labour productivity.

As we have already seen, the forecasts of the XXI Congress that the USSR would "catch up and outstrip in the near future the USA in labour productivity" (*The Extraordinary,* 1959, Vol. 1, p. 113) has not been fulfilled.

The prospects of USSR in labour productivity in agriculture do not seem too promising.

Although the State makes big capital investments in the production of new equipment and mineral fertilizers and the construction of land-improvement systems, "labour consumption in agriculture is being reduced at a too slow rate" (Kosolapov, 1983, p. 65). In 1976-1980 the productivity in this sector increased by 15 per cent or by 2.83 per cent annually, against the period 1971-1975 and in the next period 1981-1985 it was expected to raise by 22-24 per cent (*Pravda*, 28.2.1981), or by 4.2 per cent annually.

The extrapolation of these data show that in case of an increase of 2.83% yearly, the Soviet productivity will be 3 times higher in 25 years and in case of an increase of 4.2% - 5 times higher.

From the above and having in mind the difference with USA concerning productivity, we conclude that in both cases the Soviet Union has not any prospect to catch up with the now-a-days level of the American productivity in agriculture earlier than in the beginning of the next century. However, it is worth mentioning that in the previous decades the American productivity increased quicker than the Soviet one, since the lag in the productivity between the USSR and USA has widened. As we have already seen, the productivity in the USA agriculture is now, always according to Soviet data, 4-5 times higher than in USSR against 3 times two decades earlier (*The Extraordinary,* 1959, Vol. 1, p. 113). And this occurred despite the fact that "question of ensuring high rates of labour productivity have always been a key component of the Party's economic policy" (Kosolapov, 1983, p. 82).

3. *The Quality*

As we already know, the Soviet leaders do not specify when the USSR is expected to surpass the Western countries. At the same time, it is argued that this task is more of a qualitative than a quantitative character. "In the foreseeable future the USSR will catch up and outstrip the leading capitalist countries as far as the basic economic indicators ... are concerned. The accent is now more and more on efficiency and quality" (Danilov, 1980, p. 117).

However, it is well known, that indeed, in the latter the lagging of the Soviet Union is the biggest one. It is recognized that "the quality of marketable agricultural production remains low" (Yearbook USSR, 1983, p. 113), despite the fact that the General Secretary of the Central Committee of the CPSU had underlined that the Tenth Five-Year Plan (1975-1980) "... should, above all, be a five-year plan of quality" (Brezhnev, 1975, p. 509-510).

Because of the low quality of agricultural products the CMEA (COMECON)-member countries decided to co-operate until 1990 "for a comprehensive solution of the problem of raising the quality of foodstuff" (CMEA Secretariat, 1982, p. 32).

It is not easy to forecast when the Soviet Union will be in a position to secure its population with a diet similar to that of the advanced Western countries. It is estimated that the Soviet diet shall become rational if the overall volume of Soviet agricultural output increases "by 2-2.5 times" (Morozov, 1977, p. 213).

It is possible that the effective use of the productive factors might permit the USSR to satisfy its basic needs of foodstuff. But this, surely, will be more of a quantitative than of a qualitative character.

There is no doubt that "high quality means ... the fuller satisfaction of society's requirements" (Kosolapov, 1983, p. 84). However, high quality comes after quantity. But as Table 1 shows, in 1990, even if the plan has totally been fulfilled, the level of consumption in meat and meat products, in milk and dairy products, in eggs, vegetables and fruits will be considerably below the rational norms.

Under such circumstances, it is not possible to achieve high quality before achieving full satisfaction of society's requirements in quantity.

4. *The Food Programme*

In order to streamline agricultural production, eliminate bottlenecks

and food shortages, stop the heavy drain on hard currency reserves for grain purchases and to offset domestic shortfalls a long-term plan was elaborated: The Food Programme (Kouznetsov, 1984 pp. 3-19).

The prior growth of the production of food and agricultural raw materials is regarded "as the country's most important social and economic objective" (*Yearbook USSR,* 1983, pp. 112-113).

It is obvious that the fulfillment of the Food Programme by means of extensive methods is not possible. As we have already seen, the rural population in USSR, as well as in the other industrial countries, will continue to diminish. As regards the land resources, although the agricultural and the arable lands of the Soviet Union in relation to the total area of the country account only for 37 and 10 per cent respectively, the reserves of land suitable for cultivation are limited (Bystrakov, 1983, p. 18). At the same time, population is growing and more and more land is required for towns, roads and factories.

Under these circumstances, the only way to increase the production of agricultural products is to use intensive methods. For this purpose, the Soviet government has made significant investments. Concretely, during the period 1971-1980, for the development of agriculture it invested more than 300 billion rubles (*Kommunist*, 1981, No.13, p. 36).

Having in mind "the unprecedented increase over the past three five-year plan periods in capital investment for further mechanization, land improvement and chemicalization of agriculture" (Kosolapov, 1983, p. 34) and the poor results of these investments, it is doubtful whether the new "big material and financial resources, which are being allocated for further development of the agro-industrial complex" (Andropov, 1983, p. 5) and melioration (*Economicheskaya Gazetta,* No.21, 1984, p. 2, Moscow, in Russian; Krasnienkov, 1981, p. 4), will have any better results. In this respect, it has to be taken into account that the average return per unit of assets will continue to decline because the need to open up the Eastern and Northern areas, where there are manpower shortages and prevail rigorous conditions, demand far more spending on organizing production, along with vast expenditure on developing the infrastructure.

Now-a-days, the highest level of labour productivity in agriculture is reached by means of agro-industrial integration, when the technologically interlinked production units are integrated into a single process, making it possible to repattern agriculture on a large scale, based on modern science and technology.

However, in USSR, the further development of higher forms of co-operation where collective and state farms and industrial complexes merge

and form large agro-industrial complexes may not solve the problem. Despite the socialization of the means of production five decades ago, as well as the application of all kinds of associations – inter-collective-farm, inter-state-farm, collective-state-farms, the Soviet agriculture failed to be transformed into a reliable source of food for the population. The establishment too of an all-Union Ministry of fruit and vegetables for the coordination of the branches engaged in the production, procurement, storage, processing and sales of produce may not solve the problem. In Western countries there are not such ministries, but the population is supplied normally in quantity and quality with such products.

The argument that the USSR shows the other countries of the world the way to solve their agricultural problems (Sarapov, 1976, p. 5) is not valid.

5. The Problem is Political

The main reason that the vast resources, allocated for the development of the agro-industrial complexes do not bear fruitful results, is that production and labour relations do not correspond to the level of productive forces.

It suffices to say that at a time when the Soviet agriculture cannot supply the population with food and the country is importing tens of millions of tons of grain yearly, during half a century "there has not been a single case of bankruptcy of a collective or state farm" (Morozov, 1977, p. 45) out of tens of thousands of such farms. Undoubtedly, since every farm can survive, there is no need for its directors and workers to work hard and to take any initiative. However, bad weather conditions experience has convincingly shown how effective the economic incentives are, even in cases of emergency. For example, in 1981, when a drought hit Nikolayev region in those farms, where the so called payment by the job system had been introduced (the machine operator's earnings do not depend on the amount of work done according to job orders but on the final economic results achieved by his team), the yields of wheat were higher by up to one ton per hectare, or nearly 50 per cent (Yearbook USSR, 1983, pp. 114-115).

The new law, too, for the increase of the working groups' role in the management of firms, kolkhoz and organizations may not change the existing situation, since it provides that the problems will be solved through the united efforts of the administration, the party, the Trade Unions and the Communist Youth's Organization (*Pravda* 18.6.1983, p. 2 and 19.6.1983, p. 3). This means that the party organizations will continue, as before, to

play the leading role. It is recognized that the main work in the villages for the realization of the Food Programme "will be carried out in the regional Committees of the Party" (Glinskii, 1983, p. 119). The above do not leave any room for independence and for the development of any initiative, despite the contrary decisions taken by the Congresses of the CPSU. Concretely, in 1966 the XXIII Congress underlined the need to make better use of economic methods and incentives in managing the economy, to improve planning and "increase the economic initiative and independence of ... collective and state farms" (*The CPSU*, 1980, p. 67). The results, however, were very poor, if not negligible and the prospects do not look bright.

The continuing allocation of scarce resources on a priority base – nearly 15 per cent of the GNP – to the military sector, difficulties with labour supply, combined with an overall lack of effective labour discipline, a low technological base in industry, the poor performance of the transport system, especially of Soviet Railways, continuing bureaucratic rigidity, poor management and adherence to orthodox economic methodology (Fakiolas, 1982, chap. VI-VIII) – all these are factors which influence negatively the course of Soviet economy, including agriculture, and do not permit the achievement of the primary objective, which is to reverse the long-term trend towards lower economic growth.

For the purpose of achieving an economical exploitation of the existing human and material resources in Soviet agriculture, it is necessary to solve the following problems:

a) To find effective forms of labour organization and establish material and moral criteria for stipulating creativity and efficiency.

b) To develop managerial skills and techniques and adopt rapidly scientific and technological inventions in the process of production.

c) To improve radically railway and high-way transport and supply systems.

However, the solving of the above mentioned problems and the achievement of radical positive changes in Soviet agriculture (as well as in the other sectors of economy) would require a series of fundamental political decisions, inter alia the definition of the extent to which increased degree of decentralization and flexibility in the system can be compatible with the stability of the system itself.

Developments since Chernienko assumed leadership indicate that although there is a change in the style of public decision of economic policy, there are not essentially any new starting points for changes in the Soviet economic policy in the sense of structural economic reforms (Chernienko, 1984, p. 19). It is evident that apart from criticizing existing grievances and

analyzing the various problems, the leadership will avoid using fundamentally new means to resolve them and that it will confine itself to efforts for the improvement of the performance of the existing system. The changes to be made will be rather marginal than radical.

Conclusions

The crisis in the Soviet agriculture has a permanent character and its causes are connected with the collectivization from the very beginning. The lack of adequate foodstuff for more than half a century, the need of the country to import big quantities of agricultural products and first of all grain, show that the collectivization forced the Soviet agriculture to be put on unhealthy roots.

If the collective farms were built not coercively, but on the basis of economic laws, surely today the Soviet Union would have had an adundance of foodstuff and an agriculture with which no other country in the world would be able to be compared. But this could be achieved neither in the USSR, nor in any other country, but especially in the former, which lagged so many decades from the industrial countries. The laws of social and economic development did not permit this.

That is why, too, there are no prospects, at least in our century, for the agricultural sector of USSR to surpass the USA and other advanced countries in labour productivity and in quality of products.

It is obvious that the present economic problems of USSR in agriculture, as well as in the other economic sectors, demand political solutions.

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L'AGRICOLTURA SOVIETICA: I PROBLEMI, LORO CAUSE E PROSPETTIVE

Il problema attuale dell'agricoltura sovietica è legato alla bassa produttività cui consegue insufficiente disponibilità di alimenti e necessità di importazioni. Questo accade malgrado i buoni propositi della collettivizzazione i cui obiettivi, enunciati nel 1928, erano quelli di condurre l'agricoltura sovietica ai primi livelli mondiali per tecnologia e produttività. Fatto cento il livello statunitense, il livello sovietico è oggi 20-25 sulla base di dati sovietici (l'autore ritiene che tali dati sottostimino ampiamente il divario effettivo). In realtà è ben noto che problemi e difficoltà hanno cominciato a emergere affliggendo l'agricoltura sovietica all'indomani stesso del processo di collettivizzazione. Secondo analisti sovietici le cause dei fenomeni qui discussi risiederebbero in: 1) rapidità dell'industrializzazione; 2) pericolo imperialistico e 3) situazione climatica e avverse condizioni meteorologiche.

In realtà è ben noto che la collettivizzazione è stata una scelta imposta a un paese ben lungi dall'esser maturo ad accettarla: essa ha comportato l'utilizzo di metodi coercitivi imponenti e il risultato è stato la cancellazione di ogni sistema d'incentivo produttivo. Ancor oggi naturalmente, non soltanto la ripresa produttiva può essere prevista solo a lungo periodo, ma essa resta dipendente da scelte politiche di fondo.

RECENSIONI

BARANZINI M.-SCAZZIERI R. (eds.): *Foundations of Economics. Structures of Inquiry and Economic Theory,* 1986, Oxford, Basil Blackwell, pp. 454.

Discutere sul tema delle strutture di indagine nella teoria economica e, più in generale, della conoscenza in economia è un compito assai impegnativo.

Mauro Baranzini e Roberto Scazzieri lo hanno fatto proponendo, rivolti soprattutto agli economisti di professione, una raccolta di saggi scritti da autorevoli economisti e riuniti in un volume dal titolo *Foundations of Economics. Structures of Inquiry and Economic Theory*, di cui sono i curatori.

Baranzini e Scazzieri nel loro ampio saggio introduttivo « Knowledge in Economics: A Framework » (pp. 1-87) delineano il programma scientifico e lo scopo del volume.

L'idea principale che percorre l'insieme dei saggi proposti è che *produzione* e *scambio* sono i due temi fondamentali intorno a cui si sono andate sviluppando due distinte linee di ricerca che hanno caratterizzato la dinamica storica della teoria economica; la linea di ricerca dello scambio che tratta originariamente i problemi dell'allocazione e delle decisioni « razionali » degli individui, e la linea di ricerca della produzione che tratta l'organizzazione sociale, la produzione ed il mutamento strutturale.

Il concetto di *linea di ricerca* è quindi cruciale per comprendere il significato dell'intero volume. Baranzini e Scazzieri intendono per linea di ricerca un insieme di teorie caratterizzate da ipotesi e concetti comuni, tali che ciascuna di esse si colloca quale avanzamento lungo una data traiettoria. Ciò implica che la teoria presa in considerazione dipenda da quelle precedentemente formulate lungo la stessa linea e/o che tale teoria sia essenziale nella formulazione delle successive lungo la medesima traiettoria. È altresì importante sottolineare che distinte linee di ricerca possono avere numerosi punti in comune, poiché una data teoria può essere influenzata da teorie che appartengono alla linea di ricerca A ed essere, allo stesso tempo, essenziale alla formulazione di un'altra teoria, che appartiene alla linea di ricerca B.

Detto questo, risulta più chiaro lo scopo dichiarato dai due curatori di voler contribuire alla valutazione dell'opinione che la conoscenza in economia è associata con lo sviluppo concorrente di due distinte linee di ricerca, dello scambio e della produzione, ciascuna delle quali osserva la disciplina da angolazioni differenti, ha un diverso nucleo originario e « compete » con l'altra arricchendo il proprio nucleo originario con elementi della linea di ricerca concorrente.

La tesi di fondo sostenuta da Baranzini e Scazzieri che la conoscenza in economia, e più in generale la conoscenza scientifica, non possa e non debba ridursi ad un piatto unanimismo che esclude qualsiasi confronto dialettico fra linee di ricerca alternative e concorrenti a noi sembra pienamente condivisibile.

John Hicks e Luigi Pasinetti [1] sono gli ispiratori dell'approccio seguito dai nostri curatori, e

[1] Cfr. in proposito HICKS J., 1976, « 'Revolutions' in Economics » in *Method and Appraisal*

non è un caso quindi che due loro saggi, « Is Economics a Science? » di Hicks e « Theory of Value – A Source of Alternative Paradigms in Economic Analysis » di Pasinetti, rispettivamente aprano e chiudano la raccolta di contributi del volume. Affermano in proposito Baranzini e Scazzieri:

« Hick's and Pasinetti's viewpoints complement each other, in the sense that Pasinetti stresses the influence of external events on the internal dynamics of economic theory (see his associations between the phase of trade and mercantilism, the phase of industry and classical political economy); whereas Hicks stresses how changes in economists' concentration of attention might also be independent of changes in the basic characteristics of economic life (see his explanation of the 'triumph of catallactics' which runs in terms of the intellectual superiority of the exchange over the production research line at the time when the overtaking took place) » [2].

Essi propendono quindi per una ricostruzione storica dell'analisi economica che valorizzi sia i fatti esterni (sottolineati da Pasinetti) sia quelli interni alla teoria economica (evidenziati da Hicks), collocandosi in tal modo in una posizione mediana non molto dissimile da quella assunta di recente da A. Quadrio Curzio e R. Scazzieri nel saggio « Sui momenti costitutivi dell'economia politica » [3].

Procedendo nella loro ricostruzione storica dell'analisi economica, ben documentata ed arricchita di citazioni di numerosi economisti del passato e contemporanei, Baranzini e Scazzieri fanno due acute osservazioni.

La prima è che il perdurare di modelli ideali alternativi che si riconducono alle linee di ricerca dello scambio e della produzione e la formulazione di teorie economiche rivali si può ricondurre in parte all'esistenza in economia di un doppio linguaggio, quello della disciplina scientifica ed il linguaggio ordinario dell'economia pratica; e che quindi teorie economiche rivali derivano la loro identità da un uso unilaterale dei termini economici del linguaggio ordinario, attribuendo a tali termini significati diversi.

La seconda osservazione è più profonda e riguarda l'identità stessa dell'economia e degli studiosi che ad essa si dedicano. La dinamica storica della conoscenza economica è stata infatti caratterizzata dall'intrecciarsi nel tempo di due distinte concezioni della disciplina. Da un lato una concezione *pratica* sottolineata soprattutto dalla scuola di pensiero neoclassica, ovvero da quegli economisti che seguono la linea di ricerca dello scambio (i « catallattici » di Hicks) per i quali l'economia rientra nella teoria generale delle azioni umane e dei comportamenti ottimizzanti, diventando quindi prasseologia. Dall'altro una concezione *speculativa* tipica dell'economia politica classica, che ha portato avanti la linea di ricerca della produzione, la cui caratteristica distintiva è la ricerca di leggi oggettive, piuttosto che la formulazione di regole. L'attenzione degli economisti aderenti a questa seconda concezione si incentra sul produrre e lo scambiare considerati come processi effettivi e reali, piuttosto che sulla produzione e lo scambio, concepiti come casi astratti di un comportamento premeditato. La teoria economica è così costruita quale insieme di conoscenze effettive piuttosto che quale insieme di regole pratiche, e ciò fa apparire la relazione mezzi-fini in una posizione di secondo piano [4].

In conclusione, il volume riflette l'interesse dei curatori verso due tematiche: la persistenza

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in Economics, a cura di S.J. Latis, Cambridge University Press, Cambridge, pp. 207-218; e PASINETTI L.L., 1965, « A New Theoretical Approach to the Problems of Economic Growth », in *Econometric Approach to Development Planning*, North-Holland, Amsterdam, pp. 571-696.

[2] BARANZINI M.-SCAZZIERI R., *op. cit.*, pp. 12-13.

[3] *Giornale degli Economisti e Annali di Economia*, 1984, pp. 37-76.

[4] BARANZINI M.-SCAZZIERI R., *op. cit.*, pp. 27-28 e 59-61.

in economia di concezioni teoriche divergenti, e la relazione che intercorre fra le concezioni teoriche riguardanti la scienza economica e gli schemi conoscitivi forniti da altre discipline. Riguardo al primo punto in particolare, risulta evidente la contrapposizione con coloro i quali affermano, invece, che l'economia è caratterizzata da un unico approccio e che la dicotomia scambio-produzione è inesistente o semplicemente pretestuosa. Christopher Bliss nel saggio « Progress and Antiprogress in Economic Science » riportato nel volume (pp. 363-376) è appunto il paladino di quest'ultima tesi.

La struttura del volume si compone di quattro parti, che assieme comprendono tredici saggi, oltre al già citato saggio introduttivo dei curatori.

I contributi della parte I, « Perspectives on economics and the dynamics of knowledge », prendono in esame le relazioni che intercorrono tra economia ed altre forme di conoscenza. In questa parte I troviamo i saggi di John Hicks e di Bernard Schmitt.

I contributi della parte II, « The core and the extensions of exchange-oriented theories », e della parte III, « The core and the extensions of production-oriented theories », considerano rispettivamente la struttura logica delle linee di ricerca dello scambio e della produzione. Alcuni di questi contributi sono delle ricostruzioni storiche, a volte critiche, delle rispettive linee di ricerca; essi evidenziano tra l'altro il fatto che ogni linea di ricerca tende a generare tematiche di indagine che coprono l'intero dominio dell'economia. Altri sono dei veri e propri contributi « in progress » lungo la linea di ricerca preferita. Abbiamo quindi per la parte II i saggi di Maurice Allais, Michael Bacharach, Dieter Helm, Klaus Hennings; per la parte III i saggi di Nicholas Georgescu Roegen, Michael Landesmann, Alberto Quadrio Curzio, Krishna Bharadwaj.

La parte IV, « From the ancients to the moderns: a reappraisal of the dynamics of change in economic theory », con i saggi di Christopher Bliss, A. Quadrio Curzio – R. Scazzieri, e di Luigi Pasinetti, riconsidera criticamente la dualità scambio-produzione quale fondamentale quadro di riferimento per l'analisi economica e rivisita la dinamica storica della conoscenza economica alla luce di tale distinzione.

DANIELE SCHILIRÒ

CANDY V.J.: *Signal Processing, The Model-Based Approach.* 1986, New York-Hamburg, McGraw-Hill Company, pp. 240, DM. 126,70.

Il libro, svolto a livello piuttosto elevato, richiede una buona conoscenza dei processi stocastici nonché della teoria dei sistemi lineari, con particolare riferimento al problema dello spazio degli stati.

La parte fondamentale del testo riguarda i modelli relativi ai segnali: in questa area vengono utilizzati dei modelli stocastici molto noti, come i processi autoregressivi o a media mobile con input e anche i modelli dello spazio degli stati.

Il contenuto è articolato in sette capitoli più diverse appendici.

Il primo capitolo discute i concetti fondamentali sui modelli che riguardano i segnali e pone le basi per i successivi sviluppi. Viene esaminata con particolare attenzione la tecnica impiegata per rettificare (o adottare) la stima corrente, quando si dispone di un nuovo dato.

Nel capitolo secondo si discutono i modelli utilizzati per i processi stocastici: si esaminano prima alcuni processi particolari di tipo più elementare, per passare poi all'introduzione dei modelli ARMAX (autoregressivi e media mobile con input stocastico) e ai modelli dello spazio degli stati.

La teoria della stima, il metodo della minima varianza, dei minimi quadrati e della massima verosimiglianza vengono sviluppati nel capitolo successivo.

Il capitolo quarto tratta gli aspetti teorici del filtro di Kalman, usando l'approccio basato sulla innovazione (innovation approach), utilizzando poi la teoria di Gauss-Markov e infine quella bayesiana.

Invece gli aspetti pratici dello stesso filtro sono studiati nel capitolo successivo (il quinto), mentre l'estensione della teoria del filtro di Kalman alla soluzione di problemi particolari viene esposta nel capitolo sesto. Qui vengono discussi alcuni esempi di simulazione, nonché stime non lineari ottenute con metodi di linearizzazione.

L'ultimo capitolo è dedicato al filtro classico di Wiener e ai suoi legami con lo stimatore di Kalman. Il filtro di Wiener viene esaminato in termini dell'approccio innovativo e si mette cosí in evidenza come diverse tecniche di identificazione possono essere considerate come tecniche legate al filtro di Wiener.

Il libro termina con una vasta serie di appendici che spaziano da un breve riassunto sulle probabilità, all'analisi dello spazio degli stati, dall'inversione di matrici col metodo di suddivisione della matrice stessa allo studio dei vettori casuali di tipo gaussiano, ad alcuni sofisticati programmi per calcolatori.

Si tratta, a nostro avviso, di un testo molto ben concepito, agevole da studiare anche per il contributo delle appendici sopra indicate che illustrano alcuni punti non sempre sviluppati nei testi che studiano questi argomenti.

LUIGI VAJANI

ALESSANDRINI S., SECCHI C.: *Il ruolo delle trading company nel processo di internazionalizzazione dell'economia italiana,* Milano, Franco Angeli, 1986.

Il libro rappresenta la seconda tappa del lavoro svolto dal Gruppo di studio sui problemi del commercio estero, gruppo che opera dal 1978 nell'ambito del Cescom. Infatti dopo un quinquennio di ricerche sugli aspetti microeconomici del commercio estero, da cui è scaturito il volume della stessa collana "Gli operatori commerciali nel processo di internazionalizzazione dell'economia italiana", l'attività del gruppo si è concentrata sul commercio internazionale di servizi (il riferimento d'obbligo è alle trading company) da cui prende l'avvio il seguente volume.

In esso si esamina come le tendenze attuali di competitività, protezionismo ed ostacoli vari al commercio mondiale rendano la vita più difficile alle attività di esportazione ed importazione. Si giustifica così la presenza delle trading company come unità funzionali indipendenti per il servizio al commercio di beni. Le trading company oltre alla funzione commerciale primaria infatti offrono servizi ausiliari e complementari che aumentano l'efficienza del commercio estero per il produttore.

Oltre alla relazione generale sullo stato del dibattito di S. Alessandrini, il volume presenta interessanti contributi che illustrano ruolo e potenzialità delle trading company: dall'esame del punto di vista pubblico, a quello bancario e parabancario; dal confronto con i consorzi export e con le piccole e medie imprese, al ruolo di sviluppo nella politica regionale; dal contesto di attività di servizio, alla internazionalizzazione e al confronto con le esperienze americane.

Nel complesso quindi un volume che fa luce efficacemente su tali problemi delle trading company utile per operatori e per il dibattito teorico.

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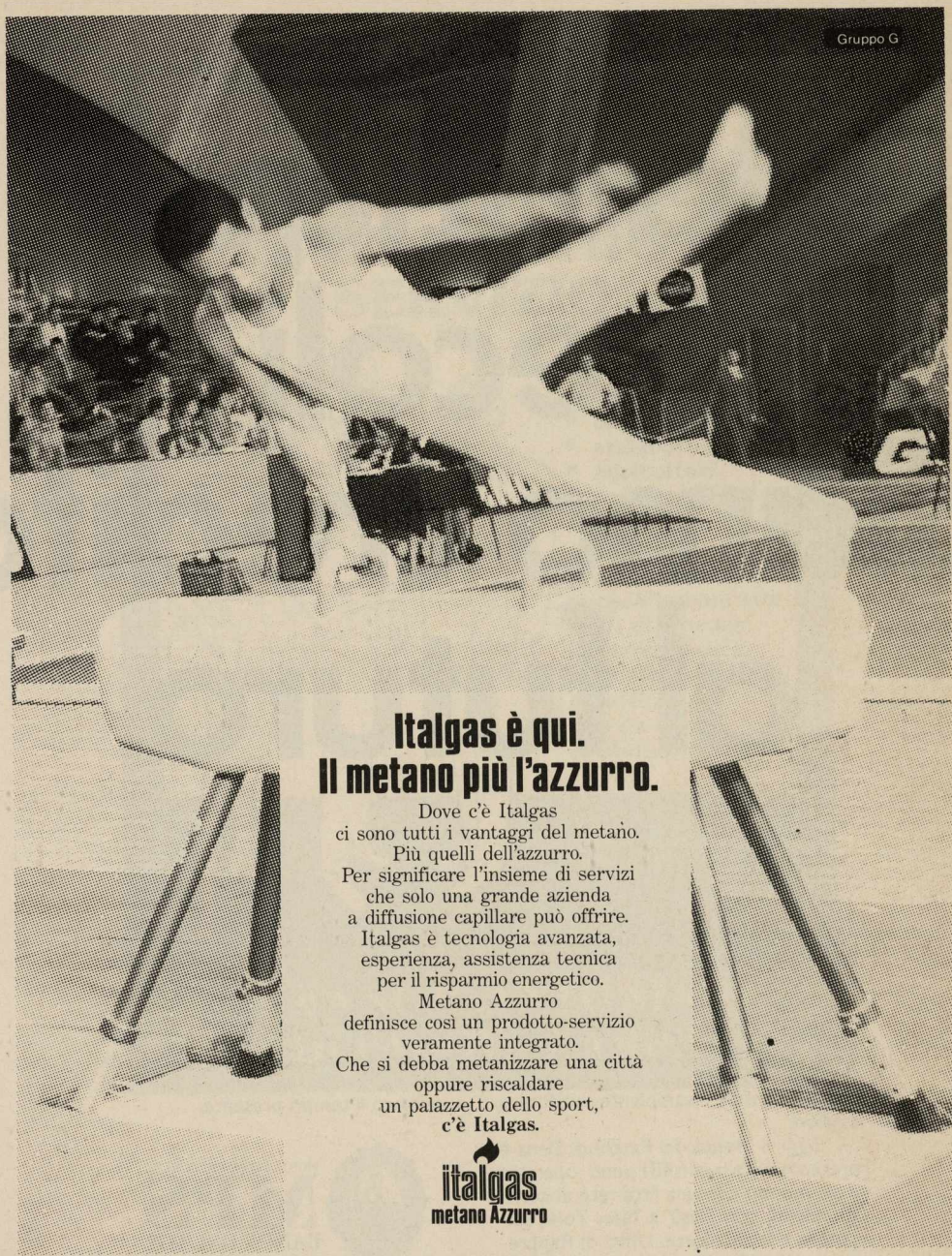

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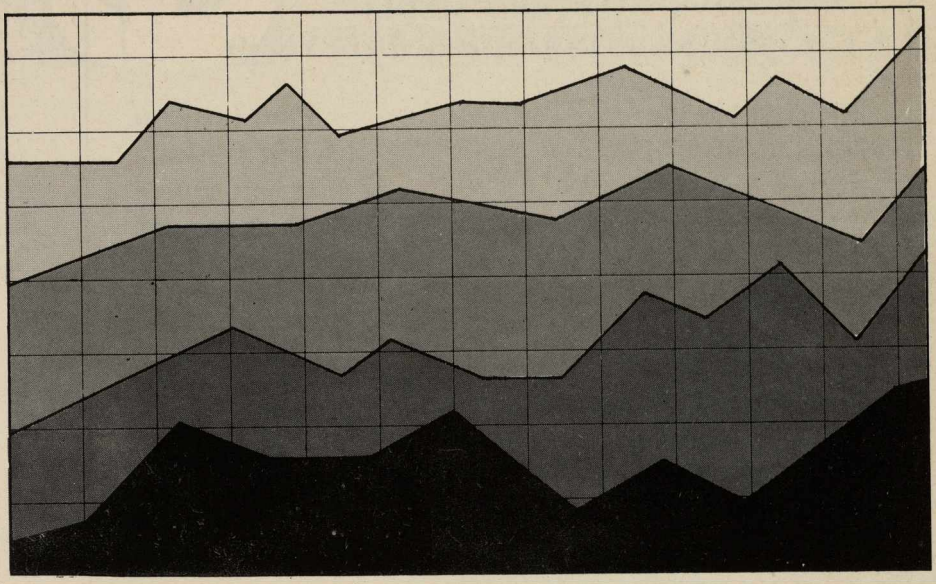

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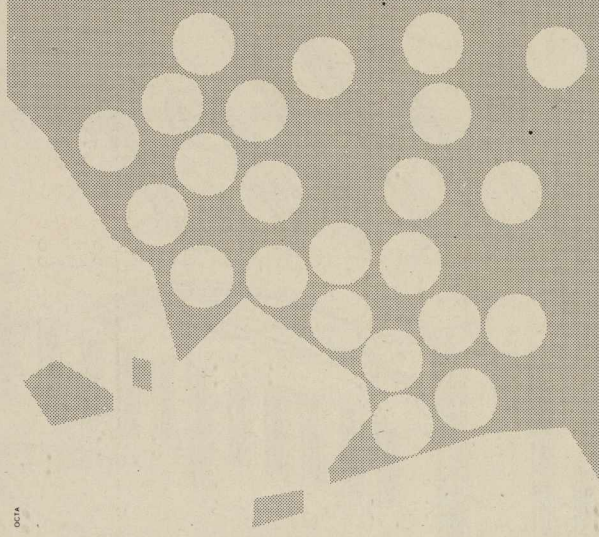

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